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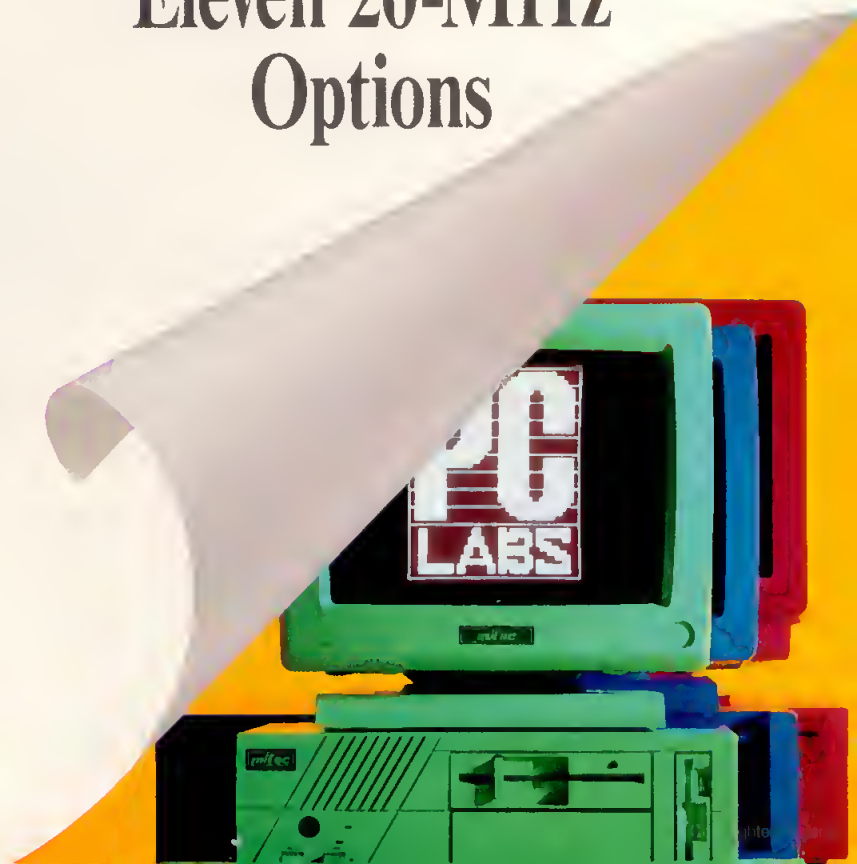
MAGAZINE

VOLUME 7 NUMBER 12
JUNE 28, 1988

There's a 386 In Your Future

PC Labs Investigates Eleven 20-MHz Options

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- Desktop Publishing: Expert Tips On Type
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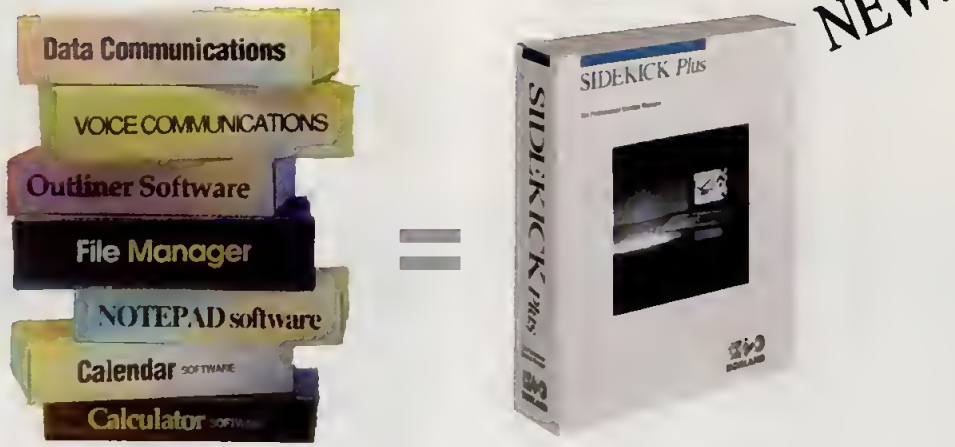
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Wait State	Zero	Zero	Zero, Norton V3 SI rating: 16.3
RAM	1MB static column	1MB static column	612K DRAM (80ns)
On Board Expansion Memory	Up to 4MB	Up to 4MB	Up to 4MB
System Expansion Memory	Up to 12MB	Up to 12MB	Up to 16MB
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Controller Card Handles	2 hard disks, 2 floppies	2 hard disks, 2 floppies	1 hard disk, 1 floppy
Disk Drive(s) Included	1.2MB floppy drive	1.2MB floppy drive	20MB hard drive, 1.44MB floppy drive
Clock/Calendar	Yes	Yes	Yes, with 10-year battery life
Ports	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter
Expansion Slots	1 32-bit memory bus, 6 16-bit, 2 8-bit	1 32-bit memory bus, 5 16-bit, 2 8-bit	3 16-bit, 2 8-bit
Keyboard	101-key enhanced	101-key enhanced	86-key
Power Supply (watts)	200	200	200
Reset Switch	Yes	Yes	Yes, with 2-second safety delay
BIOS	Award 32-bit ROM	Award 32-bit ROM	Phoenix
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Math Co-Processor Support	80287	80287	8087
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Ports	2 serial, 1 parallel, joystick adapter	2 serial, 1 parallel, joystick adapter	1 serial, 2 parallel, game port
Expansion Slots	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	8 8-bit
Keyboard	101-key enhanced	101-key enhanced	84-key standard
Power Supply (watts)	200	200	150
Reset Switch	Yes, with 2-second safety delay	Yes, with 2-second safety delay	Yes
BIOS	Phoenix	Phoenix	DTK
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WHAT'S INSIDE

If you're still nagged by doubts that the 80386 microprocessor is becoming the chip of choice in desktop computing, set them aside.

It's happened. In February IBM announced that every member of its PS/2 family would receive an 80386-based brain transplant by the end of 1989. Market research quoted by AST indicates that the number of 386 machines shipped in 1987 will grow tenfold—from 200,000 to 2,000,000—by 1989. Now there's something that warms the heart of an entire industry—exponential market growth.



Contributing editor Winn L. Rosch headed the team of reviewers that set out to discover how fast 20-MHz 386 machines really are.

Contributing editor Winn L. Rosch says there's no reason to delay a 386 purchase. In this issue's cover story, which begins on page 93, he concludes 20-MHz 80386 machines may be the best blend of "compatibility, throughput, and proven reliability you'll find for quite some time."

Winn should know. Not only has he written extensively on 386 technology for *PC Magazine*, but as we were putting this issue on our press, Winn's latest book, *Power Computing: Multitasking and Application Management with your 80386*, was coming off the Bantam Books press.

Winn, who has written for *PC Magazine* since 1981, has distinguished himself within the industry for the insights he brings to each assignment and his attention to detail. His article on the Lotus look-and-feel suit ("The Copyright Law on Trial, May 26, 1987) was recently named Best Feature in the Computer Press Association Awards competition.

It was at these same awards that *PC Magazine* was named Best Computer Magazine and took first place for Best Editorial Opinion Piece (see Bill Machrone's column "Coming to Terms with OS/2," October 27, 1987).

Pardon us if we seem a bit proud but, as Casey Stengel said, "If you can do it, it ain't bragging." And here at *PC Magazine*, we pride ourselves on "doing it" all the time.

Part of our pride comes from having the right tools to do just one of the things we do best—evaluate products. This issue marks the debut of PC Labs' new suite of benchmark tests for PC fax systems. All those involved with the development of these fax transmission and print tests worked to create tests that would reflect true-life performance in fax. The results show they succeeded.

Finally, we bring you a second look at ALLKEYS, a utility that helps you keep hotkeys from greedy TSRs. ALLKEYS is the work of Robert L. Morton, a newcomer to *PC Magazine*. So get control of your keyboard and establish your system's pop-up pecking order. PC

Photography: Robert Holcpl

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Type casting The QMS-PS 800 II comes with 35 resident typefaces (you can download more if you like). PostScript allows you to scale type to virtually any size, from minuscule to mammoth. PostScript also enables you to design, and redesign, your documents with exacting detail. You have total control over the final appearance of documents, with the ability to place text and graphics anywhere on the page. In short, you get the complete desktop publishing power that only PostScript can give you.

Critical acclaim The QMS-PS 800 II is certain to receive rave reviews on your network. And for a single-user set-up, there's the QMS-PS 810 laser printer. For a demonstration of either, call **1-800-523-2696** for the location of the Laser Connection dealer nearest you. And be sure to ask for *The Sourcebook*™ – our exclusive catalog filled with the latest laser printer products and enhancements.

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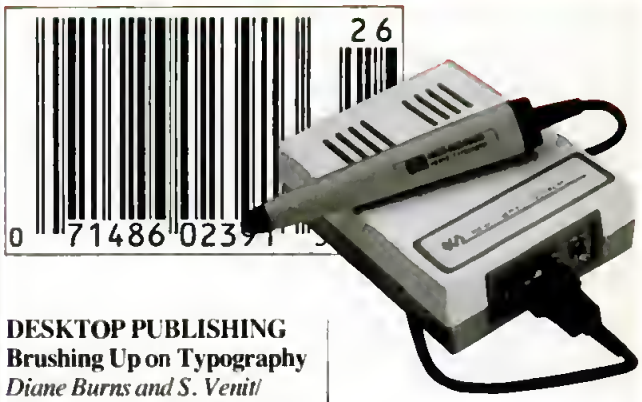
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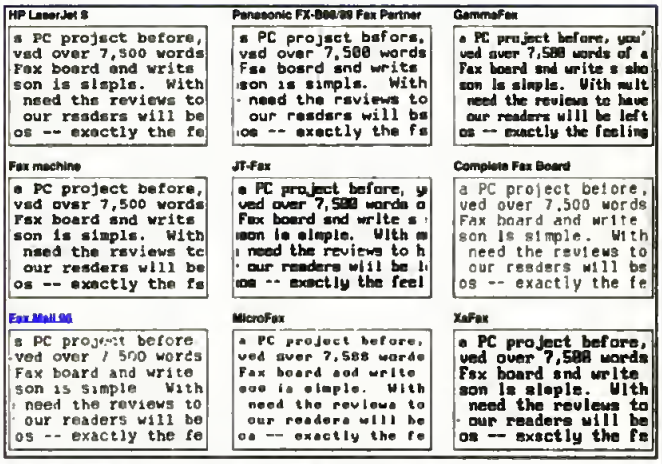
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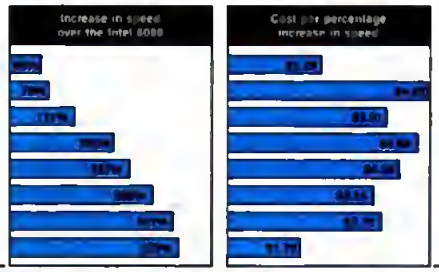
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Breakthru 286-12MHz-$595

LIGHTNING™—FREE with Breakthru speedup hardware—$89.95 purchased separately

We are excited about our three speedup products. You probably know about our Lightning disk access speedup software that was awarded PC Magazine's Best of 1986 award (see box). After the smashing success of Lightning, in late '86, we guaranteed the Breakthru 286 board to be literally the most advanced, fastest, most feature-rich board available. The runaway success it has enjoyed truly proved that assertion. Now we go ourselves one better with the Breakthru 286-12. This new board has the clock speed cranked up from 8 to 12 MHz for speeds up to 10.2 times faster than an IBM PC. It is 50% faster than an 8MHz IBM AT, and up to a whopping 1,000% faster than a regular PC.

HERE'S WHY THESE TWO BOARDS ARE SO SPECIAL.

First, they install so easily. A half-slot card means you don't even have to give up a full slot. What's more, unlike competing products it works in the Compaq Portable and most clones. Easy diagrams show how you just place the card in an open slot, remove the original processor and connect a single cable. There is no software required. From that moment you are running faster than an AT.

Second, they are advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. Has a 80287 math coprocessor slot for numeric intensive applications. A 16K cache memory provides zero-wait-access to the most recently used code and data. Speed switching software allows you to drop back to a lower speed on the fly for timing sensitive applications.

Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Expanded Memory Specification (EMS). Software compatibility is virtually universal.

Faster and smarter than an AT - PCSG guarantees it.

Fourth, these are the best. There are several other boards on the speedup market. We at PCSG have compared them all, but there simply is no comparison. Many cards offer only a marginal speedup in spite of their claims and others are just poorly engineered.

We are really excited about these products. PCSG makes the unabashed statement that the BREAKTHRU 286 card represents more advanced technology than boards by Orchid, Quadram, P.C. Technologies, Phoenix...we could go on. Breakthru 286 is undisputedly the turbo board with the biggest bang for the buck. And we include FREE the $89.95 acclaimed Lightning software. Call today with your credit card or COD instructions and we will ship your card the very next day.

But, no speedup board cuts disk access time in half

LIGHTNING

software can - $89.95 or FREE w/Breakthru

"Lightning is simost mandstory...." -
Steve Manes, PC Magazine
Best of 86 review

Loads with the DOS - always ready as a background program to accelerate disk access. You do nothing - everything is automatic. Programs that frequently access the disk (hard or floppy) are made instantly up to 2 to 4 times faster. Uses a principle greatly enhanced from mainframe technology called caching. Fully exploits Above Board memory.

LIGHTNING is the standard against which all our competition measures itself because we achieve universal compatibility with other software. Data is never lost. Order ***LIGHTNING*** separately or get it free with your Breakthru 286 board.

PC MAGAZINE EDITORS' CHOICE BEST of 1986



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Don't take our word for it. Use Lucid 3-D for 60 days. Return it for a full refund if not completely satisfied. Plus, instead of the $199 list price, an introductory spread-the-word price of $149.

Lucid 3-D is priced to sell at $199, but we want thousands of people using Lucid everyday, all over the world. We invite you to be a part of that group. The reason we are offering Lucid for only $149, on a sixty day return for a full refund, is simple. Preliminary user testing of the product produces the same results over and over. People tell us they would never work without Lucid 3-D again. Even folks continuing to work with 1-2-3.

Memory Resident

That's because the idea of a memory resident spreadsheet makes sense, one that you can pop-up instantly while working in your word processor or any other program. Lucid lets you cut anything on the screen and paste it right into Lucid, or cut anything from a Lucid worksheet and paste into the application below. You can even run Lucid on top of 1-2-3 if you like, and cut and paste information from one to the other, including formulas.

Lucid 3-D was developed over the past two years with countless, exhaustive hours of planning and programming to produce something spectacular. This is a product that works the way we dreamed a spreadsheet would function. Everyone who has seen it says things like, "*Lucid 3-D is how software of the 1990's will look and perform*", or even more to the point "*This is the way I thought a computer should work*". You'll see, Lucid is exciting.





FIG. 1 Let's get the detail on those ad costs. Just move the widebar to that cell and press one key (grey +).

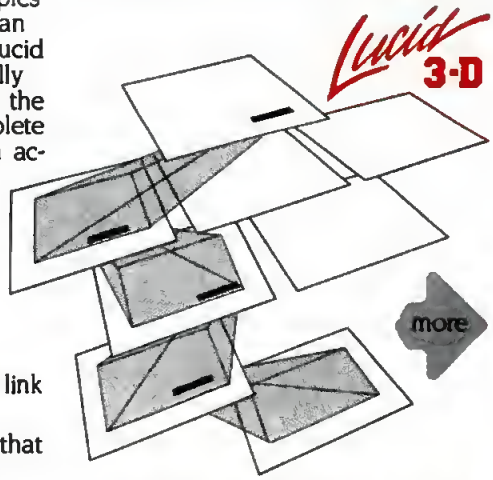
FIG. 2 Here we are, instantly. Notice the lower left corner showing we are on level 2. You can go down or up. (See next page)

What Makes it so Special

In the screen examples you can see Lucid is really multi-dimensional. Any cell of the spreadsheet can contain a complete other spreadsheet that you can access with a single keystroke. It is as simple as the pictures show. And you don't have to write formulas to do that. All you do is go look at the other file, navigating through easy, point and shoot directories. When you come back up (with one key) the link is made automatically for you.

Everything about Lucid works that way. Users say "*It is so intuitive that I really don't need a manual.*" That's because we use something we call a visual command menu. Jim Seymour, the noted PC columnist, talking about Lucid in a recent article said that, "*If there ever was an interface idea so good it ought to be stolen and widely used, this is it.*"

What he was talking about is a new menu approach that follows a simple design concept: it is easier to recognize than it is to remember. As choices are made on a menu that take you to lower levels you always can see exactly where you came from and where you are going. The complete menu path is always visible. You cannot get lost several levels down. This means you never have to remember a command, you just flow right to it.



1-800-544-4699

Any cell can contain a complete other spreadsheet that you can access with a single key.

Plus, no matter where you are on a menu or what you are doing, just press function key F1, and you will get a help screen specific to that command or action. Or if you want to know about any subject you can pop up an index of over 400 topics and select the one you want.

Notepad Behind Every Cell

Another 3-D feature is that any cell can also contain a multiple page note that you instantly access with a single keystroke. You can write notes, memos or letters that relate to your work, save them as individual files and even print them separately or with your spreadsheet.

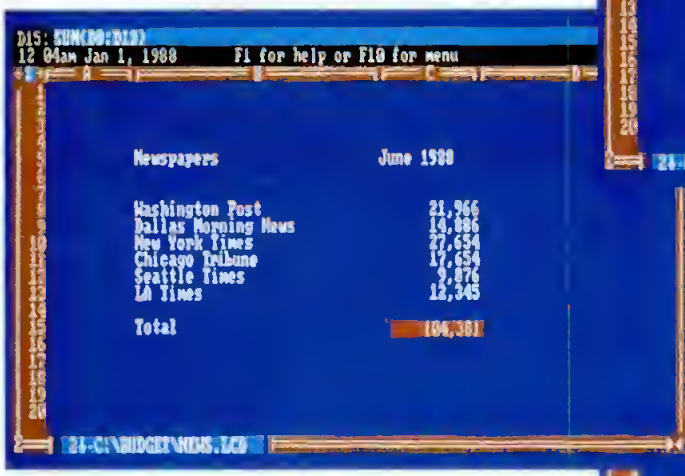




FIG. 3 We want more detail, so let's go to Newspapers. Just press the Grey + Key

FIG. 4. Now, instantly we are on level 3. Each level is a different spreadsheet. You could now move to the New York Times and see the detail on that figure. There is no limit to the levels you can go. Move right down to transaction level if you like.

> "The best idea I've seen for a spreadsheet in years."
>
> Jim Seymour, Columnist, PC Magazine, PC Week



Fig. 5. Of course, Lucid does multiple windows. Notice, you can simultaneously open windows in different directories, different drives, even down as many as 3-D levels as you like. No one else can do that.

Speed

Lucid 3-D is truly revolutionary. It is fast, fast, fast! It is incredibly quick in performing calculations because it doesn't recalculate every cell every time you insert an entry. Instead, it only recalculates the specific cells that are affected by your change. This is called minimal recalc. Lucid also has a remarkable innovation called background recalc in which you are given control of the cursor the moment calculations affecting your viewing screen are completed. Other calculations you don't see continue on in the background during the next commands. The end result of this powerful combination is you rarely wait for a recalculation with Lucid. You find out what instantaneous is all about.

Lucid Learns

Lucid 3-D also lets you teach it any combinations of keystrokes so that involved sequences can be done with single keys. Plus more than just remembering keystrokes, Lucid allows you to create Macros with loops, procedures and conditional branching amazingly all done automatically with simple menus. You can create your own menus that show the new features you have taught it. Another great feature is you can make your custom menus work like Lucid where one choice can take you down a level to a whole new set of choices. What's nice is that they will work from one spreadsheet to another.

Mouseability

Lucid 3-D was designed for both keyboard enthusiasts and mouse lovers alike. You can take your pick. Designed around the mouse from the ground up, the interface is smooth and natural. You select files to load from directory lists. Everything is point and click. What's more, any Lucid 3-D menu selection can be "moused" and the response time is "right now" instead of the sluggish "a little bit behind you" feel of add-on mouse menu systems like those you've seen with 1-2-3.

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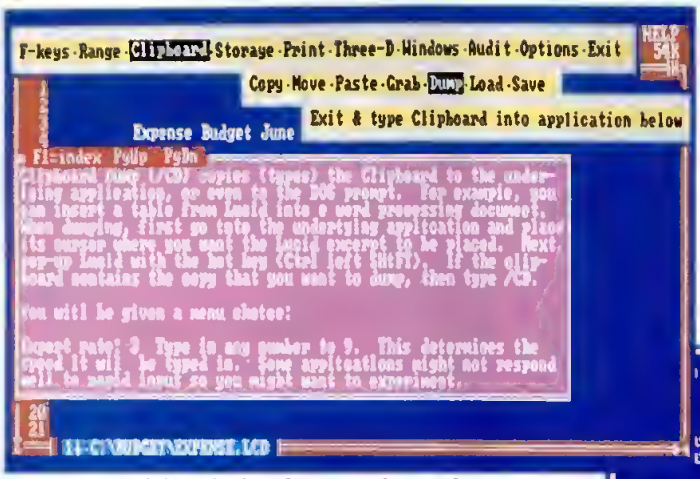


FIG. 6 We need those budget figures in the Word Perfect letter we are writing. Clipboard Dump does it right now.



FIG. 7 Here it is right in Word Perfect (or any word processor) just like you typed it. You can go the other way just as easily.

A window pops up with a library of function names you can page through with the mouse. Select, click and it's in the formula with no typing required. You even have a label window that you can fill (from the keyboard) with favorite labels and names so that you can insert them later with the mouse. There's even a pop-up calculator to insert numbers so you don't have to go to the keyboard very often.

It really permits that feeling of becoming one with your work. Lucid 3-D has windows of user defined range names as well as the macros named by the user that can be selected just by pointing and clicking. Icons that are easy to grab with the mouse let you resize and move the spreadsheet window with the ease you would expect. Plus you can go anywhere on the sheet by moving the mouse and clicking on the spreadsheet borders. And remember Lucid is designed so that any of those features are done with or without the mouse easily and quickly.

Audit

When you are staking a big decision on information gained from a spreadsheet you need to be certain that you have made no mistakes. Lucid offers five audit displays and printouts.

Masterwork

We could go on at great length about all the features and innovations in Lucid, but Lucid is more than a bag of features. What is most important is the pride and craftsmanship that went into its creation. It is a masterwork. The overall feel is tight and polished. In fact, Paul Somerson, executive editor of PC *Magazine*, used one word to describe it. "*Slick*".

PCSG has built a reputation as a development laboratory producing products that you know are excellent. In 1983 PCSG dominated the Model 100 laptop market with ROM based software that every reviewer rated as excellent. In 1985 we produced ***LIGHTNING*** the pioneer and award winning Disk speed up software. In 1986 we developed the ***BREAKthru 286*** accelerator board that blew everything else out of the water, and later we topped ourselves with the Breakthru 12. Now in 1987 those who have worked with Lucid 3-D tell us "*you have done it again. This is software everyone should have.*"

Even if you don't plan to abandon 1-2-3, Lucid makes sense. Files are converted between them with ease so there's not an interoffice compatibility problem. This means you can have the power and fun of Lucid 3-D without having to upset your present systems.

We are excited about Lucid 3-D. But don't take our word for it, take us up on our 60 day offer. Call us on our order line number and we will ship your order the very next day. This $149 offer will end as soon as our dealer network is fully stocked. But in the mean time we invite you to try Lucid as part of our "spread the news" campaign. Just pick up the phone and call us. We accept all major credit cards or you can order COD.

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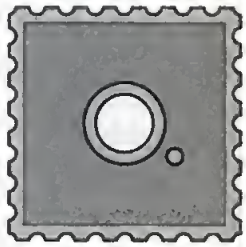
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Yes, I have an ☑ 80286/80386 PC running ☑ DOS 3.0+ and ☑ Lotus release 2.01. I also have ☑ 640KB of RAM, plus either ☑ 1MB of extended memory or I will reassign 1MB of my expanded (above-board) memory as extended memory. Please send me the database I already know how to use — the ORACLE database add-in for Lotus 1-2-3, on ☐ 5¼" or ☐ 3½" disks. Enclosed is my: ☐ check, or ☐ VISA ☐ MC ☐ AMEX credit card authorization for $199.*

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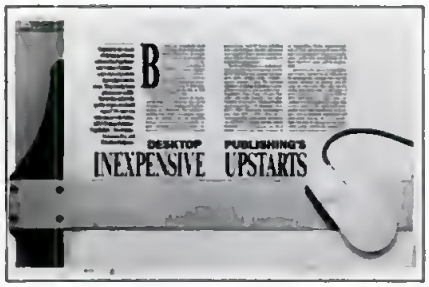
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LETTERS TO PC MAGAZINE



OUT IN THE COLD

Based on Winn L. Rosch's review of Ashton-Tate's *Byline* ("Desktop Publishing's Inexpensive Upstarts," *PC Magazine*, April 12, 1988), I purchased a copy, which turned out to be a sobering experience indeed.



Mr. Rosch said, "*Byline* supports soft fonts, but it does not support laser cartridge fonts." Nothing could be further from the truth. *Byline* does not support soft fonts, and the use of a B or F font cartridge is mandatory. Being a soft font aficionado, I thought I would be able to use many of my favorites. Instead, I learned the truth after I had broken the seal on the system disk and had to shell out another $200 for a cartridge in order to utilize the program.

Harry I. Shuman, M.D.
Tampa, Florida

Byline *was tested with an Apple LaserWriter for consistency with previous desktop publishing reviews. The information about the use with a Hewlett-Packard LaserJet was supplied and confirmed by Ashton-Tate.*—Ed.

DAGGERS FOR DVORAK

It certainly was instructive of John C. Dvorak to warn us against the overenthusiastic Unix promoters of the personal computer world ("The Big Lie," *PC Magazine*, March 29, 1988) and to continue bashing Unix, as well as taking a swipe at the National Semiconductor 32032 (a "world-famous" dud) in the April 12, 1988, "Inside Track."

By a bizarre coincidence, a computer columnist also named John C. Dvorak displayed just such misguided enthusiasm ("Inside Track," *InfoWorld*, May 27, 1985) for a 32032-based Unix system about which he wrote, " . . . it sounds like a killer if you believe what people tell you. This kind of machine is the *machine of the future*." (Emphasis not added.)

Big-lie debunker and industry seer John C. Dvorak should issue a disclaimer about big liar John C. Dvorak, lest anyone make the silly mistake of confusing the two.

Richard Entlich
Ithaca, New York

In John C. Dvorak's column "The Big Lie," he states that Unix System V has "been around since the days of the Cro-Magnon." In fact, it is a recent standardization of the most popular versions of Unix. *The New York Times* of February 24, 1988, says that in 1987, 80,000 machines with Unix System V were sold. It also states that that number is expected to increase greatly by 1992. This shows that the advantages of Unix over other operating systems are not a big lie but a fact.

In his "Inside Track" column in the same issue, Mr. Dvorak also says AT&T purchased 15 percent of Sun Microsystems and that AT&T intends to purchase the rest of Sun. In fact, AT&T purchased 20 percent of Sun and publicly stated that its stake in Sun will remain the same unless another company tries to purchase a larger share of Sun. He also talks about AT&T's ill-fated Model 7400. In fact, he is referring to the Model 7300, which was, indeed, a product ahead of the times. He also says that AT&T's contract with Olivetti is up this year. In fact, Olivetti is making AT&T's newest products, including the hot-selling AT&T 6386 EGS, which can run Unix, DOS, and OS/2.

Lastly, AT&T and Sun are not getting together to make the next generation of desktop PC clones but to make the next innovation in PC computing via the RISC technology.

Sayeed U. Rahman
Bethesda, Maryland

John C. Dvorak is quite correct when he says: "Few IBM users ever use an Apple or a CP/M clunker, so why would they care if a program looked and felt the same on another machine?" ("The Big Lie").

If all you use is a PC AT, then questions of portability and compatibility are irrelevant. But for those of us who have to move among different hardware and software systems, these benefits are tangible. Mr. Dvorak should avoid complaining about benefits not going to a group for whom those benefits were never intended.

Allen Pothoof
Hurst, Texas

(a) Even I was fooled years ago by the Unix litany. I'm just trying to keep others from making the same mistake. (b) I can never remember the model number (7200, 7300, 7400?) of that defunct AT&T Unix PC. I was amused by the fact that, with its oversized keyboard and bizarre shape, it was impossible to put it on a desk of any size. We can expect oversights like this to continue. (c) So? What's your point? —John C. Dvorak

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CIRCLE 302 ON READER SERVICE CARD

■ LETTERS

AND ROSES TOO . . .

Thank you for the most informative personal computer magazine on the market. Please keep supporting even your controversial editors, like John C. Dvorak. We need people like Dvorak to keep us away from complacency and blind acquiescence to IBM.

Xavier Le Hericy
Corvallis, Oregon

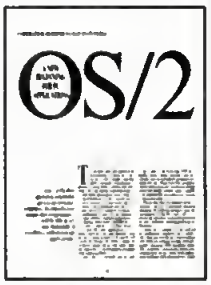
I must agree with what John C. Dvorak said in his column "Crossroads Ahead—Look Out for Turncoats" (*PC Magazine*, April 12, 1988). It *is* time for a serious update of the PC's user interface. The mouse-based graphical interface allows new Macintosh users to more-or-less pull their machines out of the packing boxes and go to work immediately. Meanwhile, the new PC user is stuck learning a series of commands and keystrokes better suited to mainframe and minicomputer systems.

■ We need people like Dvorak to keep us from complacency and blind acquiescence to IBM.

Ace Freeman
Jacksonville, Texas

WHAT TO DO ABOUT OS/2

In the story "OS/2: A New Beginning for PC Applications" (*PC Magazine*, April 12, 1988), Charles Petzold states, "Microsoft expects OS/2 to establish the foundations of PC operating systems for the next decade." Then, in the same issue's PC Tutor column, he says, "I believe OS/2 is going to be short-lived because the operating system has become as noninterchangeable as custom-made chips!"



You can't have it both ways! As your magazine has pointed out, this year is a very confusing one for PC users and programmers. My question is, should I buy a new 286 or 386 machine and jump on the OS/2 bandwagon, or is OS/2 dead meat?

Edgar N. Cohen
Baltimore, Maryland

For the past 6 months, senior technical editor Robert L. Hummel, not Charles Petzold, has been editing PC Tutor. The apparent discrepancy is not an inconsistency, but a simple difference of opinion between our editors. We think OS/2 will turn out to be the best solution for many people, while for others, DOS will continue to be a rich environment. Our goal is to help clear up the confusion.—Ed.

GET MODEMIZED!

The PC Magazine Interactive Reader Service is very nice—for those who have a modem. However, for those of us who do not have a modem or access to one, it is a very time-consuming and frustrating process to key program listings for the utilities. Can you make available the program listings, utilities, and indexes of stories on floppy disk at a nominal charge?

Ron Thomas
Atlanta, Georgia

No. Until recently, PC Magazine*'s only facility to distribute programs has been the Interactive Reader Service. Now PC MagNet (introduced in First Looks,* PC Magazine*, May 31, 1988) is the better way to interact with* PC Magazine*. All of* PC Magazine*'s utilities and the PC Labs Benchmark Series of tests are available on-line. Plus, there are discussion forums dedicated to every section in* PC Magazine *in which you can upload your own submission or communicate with other readers. For more information about PC MagNet, see the sidebar in the Utilities column. We think you'll find MagNet is worth the cost of a modem.*—Ed.

GOOD VIBRATIONS

In his sidebar "The Quest for the 'Least Computer'" ("Planes, Trains, and Automobiles: 12 Portables for the Road," *PC Magazine*, March 29, 1988), Jim Seymour called the Toshiba T1000's keyboard ratty. To some extent that is true, but I dis-

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John C. Dvorak
Columnist, PC Magazine

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■ LETTERS

covered that most of the objectionable noise I was hearing when using the computer on a desktop actually came from the vibration of the handle against the bottom of the case. A few strategically placed squares of spongy tape cured much of that!

Zane K. Buxton
Clarendon Hills, Illinois

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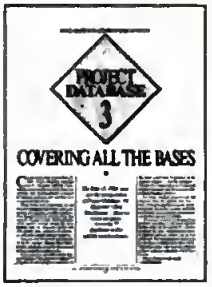
Stephen Manes's column "The Z88: Sir Clive's Latest Pipe Dream" (*PC Magazine*, April 12, 1988) is the most racist piece of product evalution that I have ever read. The British computer under review seems to be a real lemon, and its originator, Clive Sinclair, never did have the golden commercial touch. But instead of just the appropriate technical wrist-smacking, Manes couches the article in furious Anglophobia full of cheap, totally irrelevant shots about the British. *PC Magazine* has lapsed grievously in allowing itself to be a vehicle for Manes's national prejudices.

Brian Stott
Mesa, Arizona

Gee! How did I manage to overlook the fabled British sense of humor?
—Stephen Manes

WHAT'S IN A NAME

I've used versions of *PC-File*, including the latest version, *PC-File Plus*, for 2 years. My wife has written more relational hookups in it than I care to remember—and now we discover in your April 12, 1988, issue (Project Database 3: Covering All the Bases") that we've really been using a *flat-file* database.



To incorrectly classify this popular system as a flat-file database is a bit much. One would have expected your reviewer to have at least read the specifications or the index of the program under review.

Lee T. Lemon
Lincoln, Nebraska

Many of the database managers we described as flat-file databases perform hookups into other related files or report printing from multiple files. These abilities alone do not classify them as relational databases. Flat-file managers support no overlying structure joining two-dimensional tables, nor will they query several tables at once and produce an answer in tabular form. When validated against Codd's 12 rules (which explain what it takes for a database program to qualify as truly relational), these products fail on every count. However, when a tool fits the job and produces the desired results, it doesn't matter how it is classified.—Ed.

■ Manes couches the article in Anglophobia full of cheap, irrelevant shots about the British.

SWEET MYSTERY OF LIFE . . .

Bill Machrone's answers to the three magic questions ("Three Little Questions," *PC Magazine*, April 12, 1988) sure took some of the uncertainty out of life. I am learning to live with no page numbers, the cardboard pages do make handy bookmarks, and I plan to order *PC-NDX* soon.

Donald W. Hombrook
London, Arkansas

CORRECTIONS/AMPLIFICATIONS

The correct price of SOTA Technology's MotherCard 5.0 (First Looks, page 51, *PC Magazine*, April 12, 1988) is $895 for the 10-MHz version with 1MB RAM, and $995 for the 12.5-MHz version with 1MB RAM. The DaughterCard for the 10-MHz version with 1MB is $545, and that for the 12.5-MHz version is $595.

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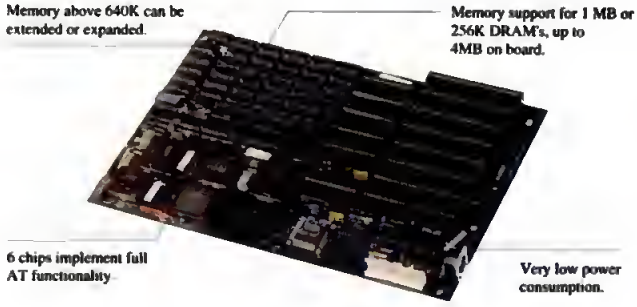
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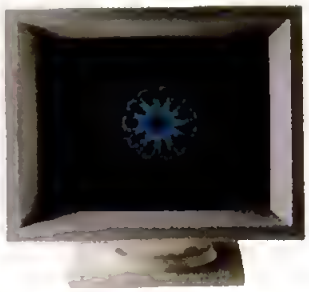
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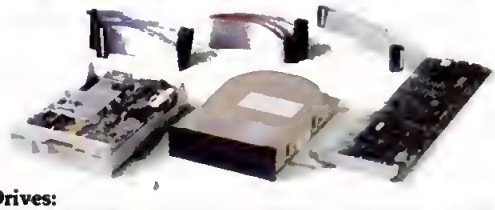
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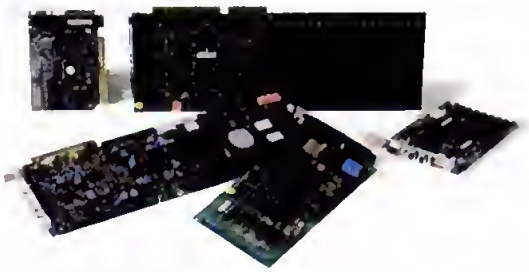
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- accumulates 940, 941, W-2 and state tax information
- produces immediate employee reports on screen or printer including W-2 forms, employee mailing labels, payroll journals, QTD and YTD reports of earnings & deductions, and employee record reports.

ACCOUNTS RECEIVABLE
- uses open invoice method to keep track of full or partial payments against any customer invoices
- fully paid invoice may be purged or retained
- automatically updates inventory and ledger accounts, and project records
- user can define aging periods
- reports produced on screen or printer including mailing labels, aged summary, aged detail and receivables journal
- automatically displays customer names and numbers on screen when required for program input
- prints computerized invoices or supports manual invoicing
- prints computerized customer statements with remittance stubs

ACCOUNTS PAYABLE
- uses open invoice method to keep track of full or partial payments against any supplier invoice
- fully paid invoices may be purged or retained
- automatically updates inventory records, project records and ledger accounts
- user can define aging periods
- produces immediate vendor reports on screen or printer including mailing labels, aged summary and details, and payables journal
- automatically displays vendor names and numbers on screen when required for program input
- prints computerized checks or supports entry of manual checks

INVENTORY
- suitable for manufacturers and wholesalers
- handles state sales taxes
- updates from receivables and payables
- uses weighted average cost method
- handles adjustments and transfers
- automatically flags reorder levels
- reports can be displayed, printed or exported
- expresses selling and cost price to three decimals

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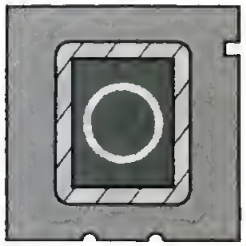
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■ MITT JONES



PC ADVISOR

Quick ways to find that particular article in PC Magazine, hard disk drives with retracting heads, and programs that reassign key functions on your keyboard.

PARKING HEADS

I am about to take a long overdue plunge and purchase a hard disk for my XT. The problem is that we occasionally suffer momentary power blackouts, and I do not want a drive that casually drops its heads on the recording surface when the power dies.

I've read that some hard disks automatically park their heads when the power is shut off, but I'm having trouble finding out which disks have this feature.

John O. Goyo
Port Credit, Ontario
Canada

Consider opting for one of Plus Development's HardCards (1778 McCarthy Blvd., Milpitas, CA 95035; (408) 434-6900). Both the $795 20MB model and the $1,195 40MB model automatically retract their heads when the power goes down. But their advantages don't stop there.

The HardCards combine the disk drive assembly and the controller on a single card that plugs into one of your expansion slots. This not only means they're easy to install, but also means you can move them from machine to machine for transferring data—or to an AT if you decide to upgrade in the future. The HardCards also draw very little power, about 8 watts.

If you would prefer a full-height internal drive, you've got many attractive possibilities—too many to list here. As a general rule, however, if the access time of the disk is around 40 milliseconds or less, you can bet the heads automatically retract. That's because faster disks use voice-coil actuators to move the heads across the platters. Retracting heads are, for all practical purposes, inherent to the design of these disks. Slower disks may also sport automatically retracting heads, however. Find a disk in your price and performance range, and ask the dealer or the disk manufacturer before you buy.

REASSIGNING KEYS

I use an XT clone with the 84-key, AT-style keyboard. I have tried the new enhanced keyboards, and the only thing I like about them is the Enter key on the number pad. I find it useful for moving the cursor and moving through menu-driven programs.

On keyboards such as mine, there is a Plus key in that location. Is there any way I can reassign that key's identity from Plus to Enter?

Bryan Alter
North Bergen, New Jersey

■ As a general rule, if the hard disk access time is around 40 milliseconds or less, you can bet the heads automatically retract.

DOS provides a crude but effective way to program simple key reassignments through the use of the ANSI.SYS file. Your DOS manual should provide instruction.

With that said and done, I can suggest that you do this the easy and fun way by picking up a keyboard macro program. Such programs not only allow you to make simple keyboard adjustments but also to assign multiple keystrokes to any key.

If you have a modem and like your software free, download ONEKEY from the PC Magazine Interactive Reader Service. A BASIC program you need run only once guides you through the key definitions and then builds a .COM file. You can then load the .COM file into your AUTOEXEC file to activate your keyboard macros each time you boot up.

There are also several commercial packages available, the most popular being Borland International's SuperKey *($99.95; 4585 Scotts Valley Dr., Scotts Valley, CA 95066; (800) 255-8008; (800) 742-1133 (in Calif.)).* SuperKey *sports a pull-down menu interface and a few nifty features in addition to keyboard macros.*

SEARCHING PC MAGAZINE

Our company is currently attempting to learn what options are available for computerized information retrieval on articles published in *PC Magazine*. Ideally, we would like a topic-oriented search, preferably resulting in the text itself, but just a reference to the article would be a big help, too.

Lawrence M. Bloom
Tampa, Florida

■ PC ADVISOR

At least for the time being, you're out of luck if you want to browse the complete text of PC Magazine *on-line. Two inexpensive sources should give you everything you need in the way of indexes, however.*

The PC Magazine Interactive Reader Service—and the new PC MagNet—offers downloadable files that list most product reviews in PC Magazine *from 1984 to the present. You can download files in* dBASE *or ASCII form and use your database software to search by subject.*

If indexes that begin with the 1986 issues will do, you're probably better off with PC-NDX (PC-NDX, Mishawaka, IN 46544; (219) 256-1045). PC-NDX catalogs 1986 and 1987 product reviews, Productivity and Viewpoints columns, and letters. Its Clipper*-compiled shell lets you search by author, product, subject matter, and* PC Magazine *category.*

A successful search yields a list of pertinent articles. You can then call up a complete citation and abstract for any of the listed articles.

Best of all, PC-NDX costs next to nothing—$8 for the 1986 index, $9 for the 1987 index, and $19 for the four quarterly volumes of the 1988 version.

■ PC-NDX catalogs 1986 and 1987 product reviews and Productivity and Viewpoints columns.

Finally, Compatible Technologies Group (115 Eatons Neck Rd., Northport, NY 11768; voice: (212) 463-8989; data: (516) 754-0575 (N,8,1)) offers an on-line article search that covers PC Magazine *and nine other computer publications. As this issue went to press, Compatible Technologies was offering access to this service—PC Reviews—without access charges. However, access to PC Reviews will carry access charges in the not-too-distant future.*

WANG-PC CONVERSIONS

In the February 29, 1988, issue, I recommended Archive-Link *and* VsCom *as ways to translate Wang VS, OIS, and Alliance files to and from various PC formats. Readers interested in obtaining the products should contact their developer—the M/H Group (222 W. Adams St., Chicago, IL 60606; (312) 443-1222).*

ASK THE ADVISOR

Send your questions to PC Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016. Please include a brief description of your system.



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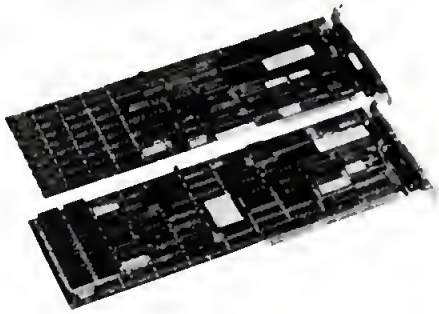
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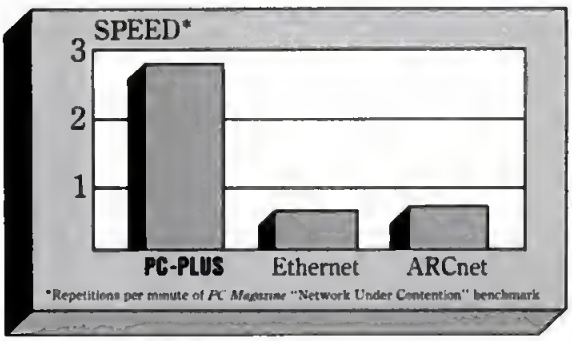
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PC MAGAZINE

FIRST LOOKS

Confronting the Growing Threat of Harmful Computer Software Viruses

PC ANALYSIS

BY JIM SEYMOUR AND JONATHAN MATZKIN

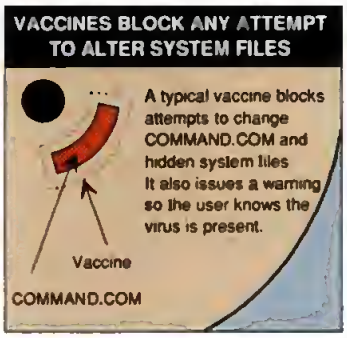
Now you see it; now you don't. Or maybe you never really saw it at all.

That will-o'-the-wisp nature of computer viruses, and the incredible difficulty of proving their role in the loss or destruction of data, have made tracking them down, defeating them, and protecting against them incredibly difficult.

It is so easy to lose data in a computer system—any computer, from a PC to a Cray supercomputer—that often, over the last few months, what was almost certainly operator error, or magnetic media wear, or power-line fluctuations, or any of a hundred other quite normal if no less frustrating events, has been misidentified as the work of computer viruses.

But that is not the whole story.

The skeptics insist that the computer virus alarms heard this spring are overstated. That skepticism has been fed by wild and unconfirmed reports, impossible to track down, of such infections as one that supposedly brought the Unix systems of a telecommunications giant to their knees, or a "PLO" virus aimed at shutting down the Israeli defense computer system.



It isn't surprising that these stories should have persuaded the skeptics that viruses are cruel jokes, this year's brand of black humor.

But the skeptics are wrong.

Computer viruses, written specifically to destroy programs and data residing in personal computers, are real and have been widely distributed. Many PC users have lost important work, at substantial cost.

Viruses exist.

The bad news: they can represent a clear and present danger to the programs and data stored on your computer's disks. But there's good news: you can avoid viruses through reasonable measures, and counterviral products are available to help detect viruses lurking on your disks and to protect against future infections.

Kenneth VanWyk knows computer viruses are real, because he's been fighting them. A Senior Consultant at Lehigh

(continues on page 34)

Why It's Time to Talk About Viruses

Over the last three months, the computer-virus story has ripped through the computer community like a prairie fire. Reports of program- and data-killing viruses have made for sensational reading in daily papers, business magazines, and some computer publications.

Many of those stories have been grotesquely exaggerated, while others have gone to the opposite extreme, denying the existence of viruses or branding them as bizarre hackers' jokes.

At *PC Magazine*, we, too, have worried about computer viruses. We have had our own encounters with them. But too many of the stories we have seen and heard were self-evidently false. Too few facts supported claims of viral disasters.

We have investigated every report we have found of computer virus infections. We have talked with those who believe they have suffered through those infections, with those who have beaten them back, and with those who have created programs to detect and, sometimes, defeat viruses.

And we have learned the chilling truth: computer viruses are very real threats. We have satisfied ourselves of their existence, of their very real damage, and of the importance of alerting computer users.

Even though we acknowledge that turning the light of publicity on those who take pleasure in destroying the work of others will inevitably encourage some of these vandals, we cannot turn away from a responsibility to warn our readers.

And to help them counter that risk. Because this has got to stop.

In the words of Don Brown, whose efforts to stop the SCORES virus on the Macintosh have been a beacon for others, "The whole thrust of the personal computer has been bringing control of the computer to the user. Viruses steal that control away, and replace it with fear, uncertainty, and doubt. Why would anyone want to take such a gigantic step backwards?"

Why, indeed?

—The Editors

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Viruses

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University's Computing Center, VanWyk has seen hundreds of IBM PC users' floppy disks erased by a runaway virus launched by a computer vandal.

"This thing was discovered about two days before Thanksgiving break last fall," VanWyk recalls. "If some students had not discovered it then, and people had gone home for the break, it could have gotten a lot worse. Because if students had taken infected floppy disks home with them it could have gone a lot farther . . . to their home machines, and from there, with Mom and Dad into their offices."

Lehigh has developed its own "vaccine," a program that checks the COMMAND.COM file at boot-up and, if it finds the virus, writes over that part of the disk. And the university has also begun using "notchless" floppy disks and encouraging the use of write-protect tabs as protective measures.

"If you don't take precautions, you're just asking for a disaster to happen," VanWyk says. And, chillingly, "Given how easy it is to write even a simple computer virus like this one, I think we have seen only the tip of the iceberg"

The virus that infected disks at Lehigh was typical of simple viral code. About 300 bytes of assembler, it looked for the COMMAND.COM file present in DOS and attached itself to it. It was then spread by duplication of that disk, or insertion of that disk into a PC with a bootable hard disk. Later, the virus began its dirty work, erasing the disk.

Then Miami University was hit by another virus, BRAIN. Joe Simpson, Assistant Manager of Academic Computing Services at Miami, had to deal simultaneously with BRAIN on the university's PCs and SCORES, yet another strain, on its Macintoshes.

"Once the epidemic was recognized, panic set in here," Simpson says. "A lot of people lost data to these viruses. We still don't feel we have a complete understanding of what happened at Miami."

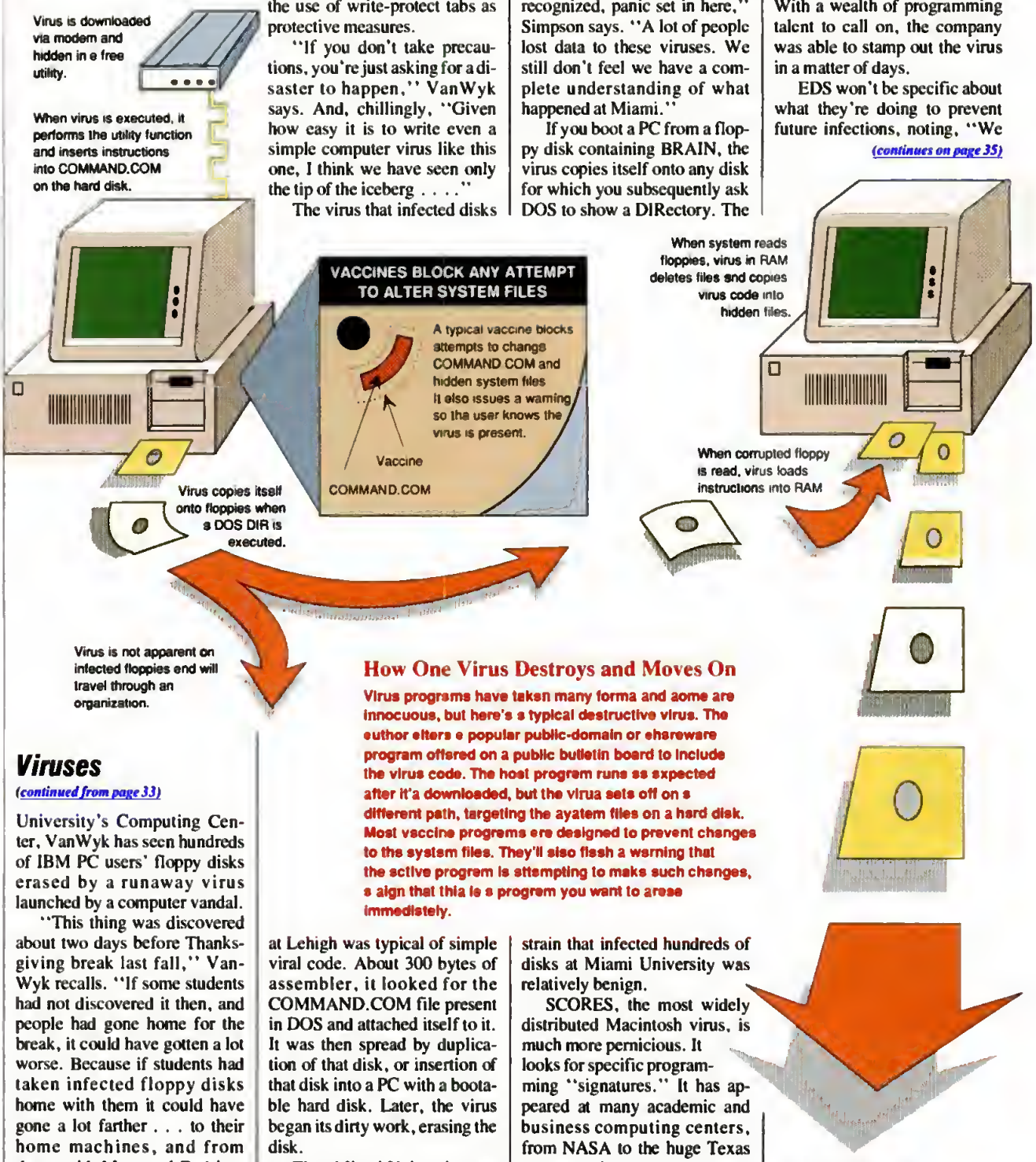
If you boot a PC from a floppy disk containing BRAIN, the virus copies itself onto any disk for which you subsequently ask DOS to show a DIRectory. The strain that infected hundreds of disks at Miami University was relatively benign.

SCORES, the most widely distributed Macintosh virus, is much more pernicious. It looks for specific programming "signatures." It has appeared at many academic and business computing centers, from NASA to the huge Texas computer firm EDS (a subsidiary of General Motors).

At EDS, two dozen Macs were quickly infected with SCORES. The programs it was affecting were first developed at EDS; the company won't talk about those programs, saying only that they were "proprietary trade-secret programs." With a wealth of programming talent to call on, the company was able to stamp out the virus in a matter of days.

EDS won't be specific about what they're doing to prevent future infections, noting, "We

(continues on page 35)



How One Virus Destroys and Moves On

Virus programs have taken many forms and some are innocuous, but here's a typical destructive virus. The author alters a popular public-domain or shareware program offered on a public bulletin board to include the virus code. The host program runs as expected after it's downloaded, but the virus sets off on a different path, targeting the system files on a hard disk. Most vaccine programs are designed to prevent changes to the system files. They'll also flash a warning that the active program is attempting to make such changes, a sign that this is a program you want to erase immediately.

Viruses

(continued from page 34)

have security and other measures in effect; we wouldn't want to go into those. One of the things we sell a customer is our ability to secure our customers' data, so we're very, very cautious with that."

Exactly. Which is why few businesses that have been attacked by viruses will even acknowledge the problem, let alone say how they countered it—or what they've done to protect against future infections.

Would you leave *your* money in a bank that had its computer system corrupted by outside software?

Moreover, no company wants to become, through foolish claims of invulnerability, The Big Test—the number-one target of those loosing these viruses on the world.

Harold Highland, Editor in Chief of *Computers & Security* magazine and a recognized expert, says it well: "My recommendation to a corporate entity would be to deny it immediately. I have advised industry that if anything like this happens, and you can kill it by denying it, kill it.

"Even the government agencies will deny it. If you go back to the invasion of NASA's physics space network, last September when they were penetrated by the Hamburg Chaos Club, and the club announced that they had planted viruses, the NASA director of data security admitted that there was a penetration and the planting of viruses.

"But within one week the story came back that, yes, there was a penetration, but there are no viruses. And since then it has been denied that there is a virus."

What to do?

One corporate answer has been to ban shareware, freeware, or other programs that have been downloaded from bulletin boards. That's the new company policy at a Fortune 50 multinational petroleum company. The company has had scores of reports of viral infections from PC-using employees, though it has not yet been able to confirm that viruses were, in fact, responsible for the incidents.

To forestall the threat, and to calm the nerves of skittish executives, the company issued a formal policy banning downloaded software.

In academic computing settings—long the target of such vandalism, though rarely so maliciously and destructively as we have seen this spring—that kind of ban won't stand up. So colleges and universities have been trying to get faculty and students to use write-protected floppy disks, and to install so-called "vaccine" programs. (See antivirus program reviews, page 36.)

Few individual PC owners will want to deny themselves the wealth of useful software available from bulletin boards, and while write-proofing your bootable floppies may be a good step, it's inconvenient and hardly a complete answer.

Common-sense measures, such as not loading new public-domain and shareware programs from unknown sources, certainly help. Most user-group disk librarians are now inoculating library disks against viral infections; if your group isn't on guard against viruses, find out why it isn't. And stop using library disks until you are satisfied that adequate security is in place.

Finally, you should consider one of the various vaccine programs. They can go a long way towards protecting your disks as well as your peace of mind. But none are complete answers, and none guarantee that you won't fall victim to the next round of cleverness in this escalating germ warfare.

Lehigh's Kenneth VanWyk again: "If you as a user recognize the vulnerabilities of the antivirus package you're using and don't rely on it 100 per cent, then there is certainly a place for these antivirus programs. The problem comes in when a user says, 'Oh, I'm running XYZ antivirus software—nothing can happen to me.'"

A sense of invulnerability can be a very dangerous thing these days in computing.

Finally, you should consider one of the various vaccine programs. They can go a long way towards protecting your disks as well as your peace of mind.

How Vaccine Programs Work

Virus programs replicate themselves. Run one and it will infect other programs on your system. Share one of those programs with friends and the virus will infect *their* systems.

If it did nothing else, a virus would still slow your work. Each infected file grows, sometimes repeatedly, so it loads slower. But most viruses include added malicious features. After they've infected your whole system, or on a given date, they may reformat your hard disk, corrupt data files, or simply cause constant small problems.

Antivirus programs attempt to foil viruses by keeping them out of your system, preventing them from replicating if they *do* get in, and blocking their malicious tricks. A good antivirus will also protect against "Trojan Horse" programs—these are like viruses without the ability to replicate. And it will protect you from *accidentally* damaging your data.

Antivirus programs work on many different levels. Some common techniques include the following.

KEEPING VIRUSES OUT

Approved Program List: Block any program not on the list. Naturally, this doesn't stop you from accidentally approving an infected program.

Known Virus Check: Scan all executable files for known viruses.

Suspicious Text Search: Display all text strings in a program. If you see "Arf, arf, GOTCHA!", don't run it!

Suspicious Code Search: Check for suspicious commands such as low-level disk writes.

Approved TSR List: Warn if any program not on the list attempts to terminate and stay resident.

PREVENTING REPLICATION

Write-Protection: Prevent writing to protected files. This should be more than merely setting the Read-Only flag.

Signature Check: Take a "signature" of all approved programs and compare the program with the signature.

Run-Time Signature Check: Whenever DOS loads a program, check it against the signature. Block it if it doesn't match.

BLOCKING MALICIOUS TRICKS

Disk Access Locknut: Allow access only through DOS file functions. This will prevent reformatting and erasure of the File Allocation Table.

FAT Copy: Save a copy of the File Allocation Table in case a virus manages to damage it. Various "unformat" programs already provide this protection.

CMOS Copy: Save a copy of the CMOS information just in case a virus does manage to damage it.

Hard Disk Lock: Temporarily block all access to the hard disk while testing suspect software. Easiest to do on AT-class machines.

—Neil J. Rubenking

Antivirus Programs Fight Data Loss

HANDS ON

BY NEIL J. RUBENKING

FLUSHOT PLUS

Antivirus programs are aggravating by nature because they can prevent you from doing perfectly normal tasks like formatting a floppy disk. *Flushot Plus*, from Software Concepts Design, provides flexibility to offset the annoyance. You can tell it to allow low-level disk access *only* until the end of the next program. That will let you run FORMAT without interruption, for example. You can also turn its protection on and off easily.

Flushot Plus is shareware, but it has more features than many commercial programs. These include approved TSR list, write-protection, read-protection, signature check, runtime signature check, disk access lockout, FAT copy, and CMOS copy.

The FLUSHOT.DAT data table lists the types of files you want to write-protect or read-protect, along with any exceptions to the type. For example, you could write-protect all .COM files except those in the "DEVELOP" subdirectory. The table also lists your approved TSRs and any files you want signature-checked. You're advised to hide this data file under a different name to avoid "smart viruses" targeted to damage it.

VACCINE, VERSION 1.2

FoundationWare's *Vaccine* provides a six-part protection program:

1) Installation and Check-Up: Checks out your hard disk arrangement and adds useful commands to your AUTOEXEC.BAT and CONFIG.SYS files. Makes listed executable files read-only.

2) Boot-Time Quality Assurance: Signature check.

3) Runtime Quality Assurance: Runtime signature check.

4) Surveillance: Disk access lockout.

5) Bomb Shelter: Hard disk lock.

6) Critical Disk: FAT copy and CMOS copy. If a virus does damage your system, reboot with the Critical disk for no-hands restoration.

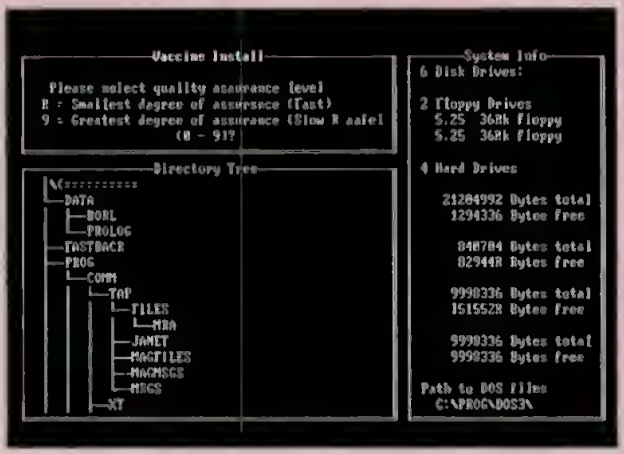
Vaccine protects all files with your chosen extensions. This is handy, since a virus could as well infect an overlay file as the main .COM or .EXE file. The Runtime module checks any file that DOS loads for execution, but only listed files get checked at boot-up.

No question, *Vaccine* will increase your boot-up time. The signature check can take several minutes, and every utility in your AUTOEXEC.BAT gets checked as it loads. Each time you add a new program you have to use the original *Vaccine* disk to approve it, and every handy utility you run will take a little longer. For a programmer it's even worse. Recompiling your program changes an executable file, which *Vaccine* flags as viruslike activity. *Vaccine* will be most useful to the millions of "office" PCs.

Indeed, FoundationWare has targeted the corporate market. With *Vaccine*, the system administrator can lock out non-approved programs. The program does require a system administrator—someone to take care of approving new programs, handling critical disks, and managing software updates. This vaccine is strict, but it will protect your system.

MACE VACCINE

Mace Vaccine, from Paul Mace Software, offers two levels of protection. At level 1, it gives write-protection to system files, the boot sector, and the partition table. It also guards against common tricks that disable the root directory. Protection level 2 adds disk access lockout. *Mace Vaccine* is best used with the *Mace Utilities*, which include a FAT copy and restore program. The program is simple and the documentation just one page, but for $20 you *do* get a degree of protection.



FoundationWare's Vaccine *checks all of your directories.*

VACCINE, VERSION 2.0

WorldWide Data's *Vaccine* consists of three programs:

ANTIDOTE—Known virus check.

CHECKUP—Signature check.

VACCINE—Approved TSR list and disk access lockout.

ANTIDOTE is fast and clean. In just a few minutes it scanned over 300 executable files on my system and flagged 10 simulated infected programs. WorldWide Data will provide "booster shots"—updates to ANTIDOTE that handle any newly discovered viruses. CHECKUP takes more time checking its signature file. Both programs check only .COM and .EXE files, so viruses that target overlays or other executable files will get past this version.

The WorldWide Data *Vaccine* programs are unobtrusive. They only scan for known viruses or checks your signature file when you ask. The manual is short, but the programs are simple enough to operate. Used systematically, they should protect against any virus that attacks .COM or .EXE files. If a virus or Trojan Horse does invade your system, they will at least prevent it from trashing your hard disk.

List Price: *Flushot Plus*, Version 1.2, Shareware registration, $10. **Requires:** 10K RAM (RAM-resident size); IBM PC, XT, AT, AT386, or PS/2, or 100-percent compatible; DOS 2.0 or later. Not copy protected. Software Concepts Design, Ross M. Greenberg, 594 Third Ave., New York, NY 10016; (212) 889-6438 (electronic BBS).

CIRCLE 445 ON READER SERVICE CARD

List Price: *Vaccine*, Version 1.2, $189. **Requires:** Minimum 384K RAM (RAM-resident size 1K); one hard and one floppy disk drive; IBM PC, XT, AT, AT386, or PS/2, or 100-percent compatible; DOS 2.1 or later. Not copy protected. FoundationWare, 2135 Renrock Rd., Cleveland, OH 44118; (800) PC-CURES; (216) 932-7717.

CIRCLE 446 ON READER SERVICE CARD

List Price: *Mace Vaccine*, $20. **Requires:** 4K RAM (RAM-resident size); hard disk; IBM PC, XT, AT, AT386, or PS/2, or 100-percent compatible; DOS 2.1 through 3.31. Not copy protected. Paul Mace Software, 400 Williamson Way, Ashland, OR 97520; (800) 523-0258.

CIRCLE 447 ON READER SERVICE CARD

List Price: *Vaccine*, Version 2.0, $79.95 **Requires:** 4K RAM (RAM-resident size); IBM PC, XT, AT, AT386, or PS/2, or 100-percent compatible; DOS 2.0 or later. Not copy protected. WorldWide Data, 17 Battery Pl., New York, NY 10004; (800) 643-3000, ext. 123; (212) 422-4100.

CIRCLE 448 ON READER SERVICE CARD

YOUR WORD PROCESSOR GIVES YOU THE POWER.

RIGHTWRITER® GIVES YOU THE CLARITY.

RightWriter Checks The Grammar, Style, Usage, And Punctuation In All Your Business Writing.

RightWriter helps you produce clear, powerful business writing. Not a spelling checker...RightWriter is a sophisticated expert system for checking errors in grammar, style, usage, and punctuation. RightWriter is aimed at producing better writing, not more writing. RightWriter helps you write like a pro.

- **RightWriter Is Extremely Easy To Use**
 You create your document as you normally would. You then run RightWriter on it, using a simple one word command. Your word processor does the rest.
- **RightWriter Inserts Messages Directly In Your Text**
 RightWriter creates a marked up copy of your original document with comments pointing out errors in grammar, style, usage, and punctuation.
- **A Readability Index And A Strength Index**
 The Readability Index shows the educational level a reader requires to understand your writing. The Strength Index measures your writing's strength of delivery. Other indexes measure your use of adverbs and adjectives, and the use of jargon in your writing.
- **Works On IBM PC, Compatibles And PS/2 With Most Word Processors**
 RightWriter supports most word processors including WordStar,® WordPerfect,® Microsoft Word,® MultiMate® and others.

Here's what the experts are saying about RightWriter

"I rarely recommend software as a must buy, but in the case of RightWriter -- four stars throughout"
-Family Computing

"...a must buy for the businessman who writes memos all day. Highly recommended."
-John Dvorak
- San Francisco Examiner

RightWriter

It's Only $95

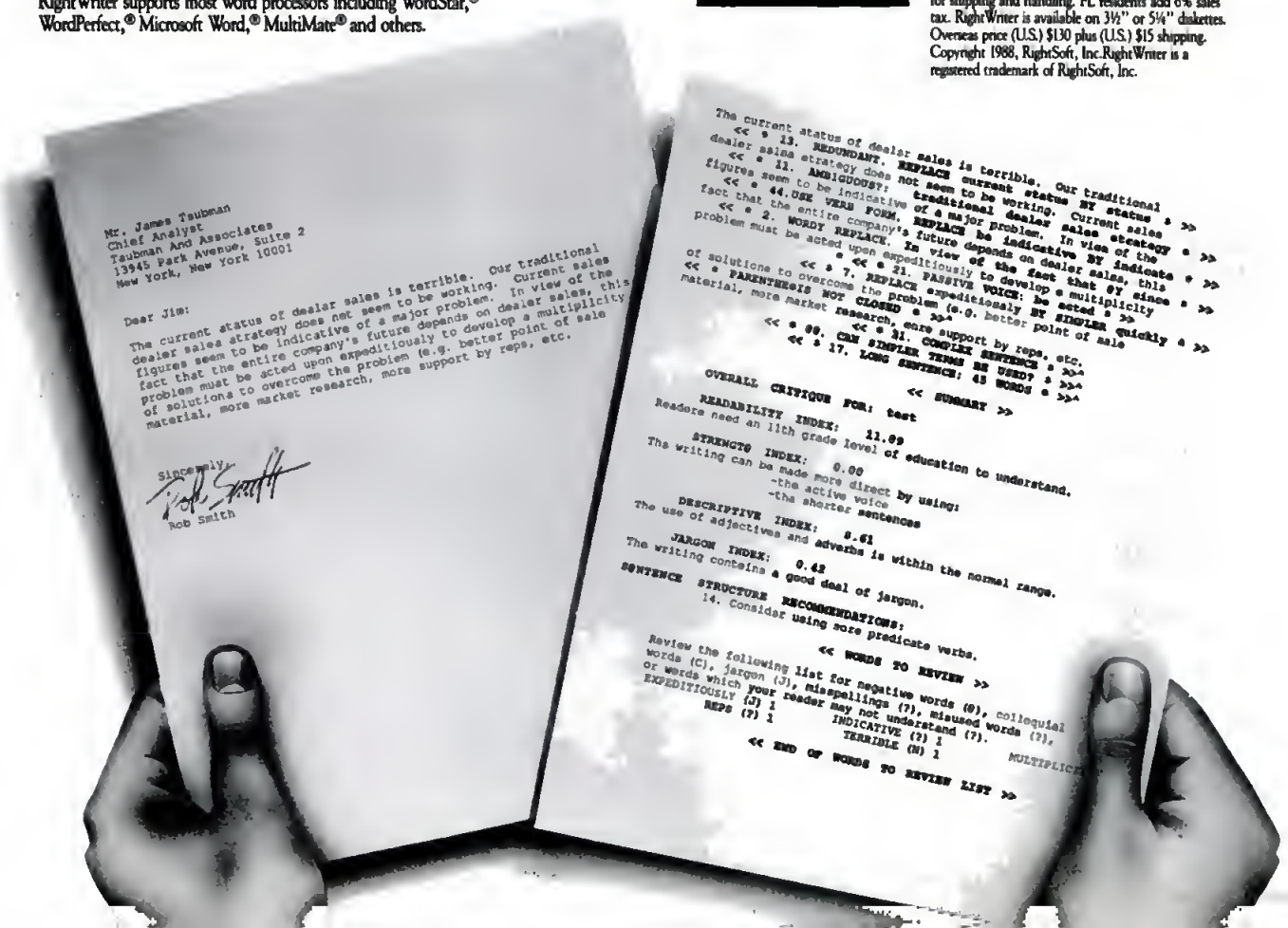
With our 30-day money back guarantee.

Ask for RightWriter at your dealer or order now by calling (800) 992-0244

CIRCLE 479 ON READER SERVICE CARD

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4545 Samuel Street, Sarasota, FL 34233
Phone (813) 923-0233 In Florida
Visa, Master Card, and AMEX accepted. Add $4.50 for shipping and handling. FL residents add 6% sales tax. RightWriter is available on 3½" or 5¼" diskettes. Overseas price (U.S.) $130 plus (U.S.) $15 shipping.
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Professional Write Upgrade Adds Document Conversion, Font Support

PC HANDS ON

BY JONATHAN MATZKIN

As they wade through their daily burden of correspondence, memos, and reports, managers need word processors that balance powerful features with ease of use. In upgrading *Professional Write*—already a great product—to Version 2.0, Software Publishing Corp. has added features that managers will find indispensable.

Professional Write 2.0 now reads and writes 13 different file formats, including *WordPerfect*, *Microsoft Word*, *MultiMate*, and *WordStor*.

Conversion is completely transparent. You choose the appropriate format from a menu and save the document as usual. Importing a document in a supported format is even simpler; *Professional Write* displays the document as you would normally see it.

Many people are squeamish about using the wide selection of fonts available through laser printers. Installing, selecting, and printing fonts can turn into a frustrating waste of time. *Professional Write* 2.0 shields the user from all that.

When installing the program, you simply tell it which printer and font cartridges you are using. Switching fonts in the course of a document is then a simple matter of highlighting the appropriate text and choosing the desired font from a menu. Unfortunately, telling one font from another on-screen is impossible.

Simplified document retrieval is another boon to users who have more-important things to memorize than filenames. If you don't enter a filename at the prompt, *Professional Write* 2.0 pops up a directory of your documents, and you just point and shoot.



One of the best new features of Professional Write *2.0 is easy availability of laser printer fonts. You simply define text and choose the font from a menu.*

No one should attempt to prepare a book manuscript with *Professional Write*. For the shorter documents that managers typically work with, however, *Professional Write* 2.0 is an excellent tool now made even better.

PC MAGAZINE FACT FILE

***Professional Write*, Version 2.0**
Software Publishing Corp.
1901 Landings Dr.
P.O. Box 7210
Mountain View, CA 94039
(415) 962-8910
List Price: $199; *PFS:Professional Write* and *PFS:Write* users can upgrade for $50.
Requires: 512K RAM (or 384K available memory), two disk drives, DOS 2.0 or later.
In Short: A word processor for managers and professionals that combines powerful features with a simple, easy-to-use interface.

CIRCLE 434 ON READER SERVICE CARD

Reference File Ties Database to Hotkey

PC HANDS ON

BY JONATHAN MATZKIN

Flat-file databases are widely used for organizing related information, and memory-resident programs are popular for their convenience. *Reference File*, from Reference Software, is the Reese's Peanut Butter Cup of the PC industry, combining these two software flavors under the same wrapper. The result is a pop-up database.

Reference File is the latest addition to Reference Software's *Reference Set Library*, which includes a dictionary, a thesaurus, and *Grommotik II*, a style and grammar checker.

The pop-up database eats a minimum of 140K RAM. Records can have up to 64 fields and up to 60,000 characters.

Like other database programs, *Reference File* offers several search methods, including global, conditional, and keyed-field searches. It is not relational, so it is most appropriately compared with flat-file software such as *PFS:Professional File*.

Reference File is set apart, however, by its memory residence. Like other pop-up software, it has cut-and-paste capabilities. You can define a block of text within a record and then export it to whatever foreground application you were working in. Text can be imported into a record as well, but this is a slightly clumsier operation.

Records in several different database formats, including comma-delimited, *dBASE*, and *Lotus 1-2-3*, can be imported to and exported from *Reference File*. That makes the program useful as a tool for quick reads and updates of database files.

Records must be converted before they can be imported. This is accomplished by running a separate utility called Rftools. Importing records is not exactly a transparent operation; using files from other programs requires a little advance planning.

The documentation supplied with *Reference File* is well written and, at times, amusing. Unfortunately, a few inaccuracies lead to confusion. Misspelled filenames and instructions that vary slightly from the actual software procedures could present problems to beginning computer users.

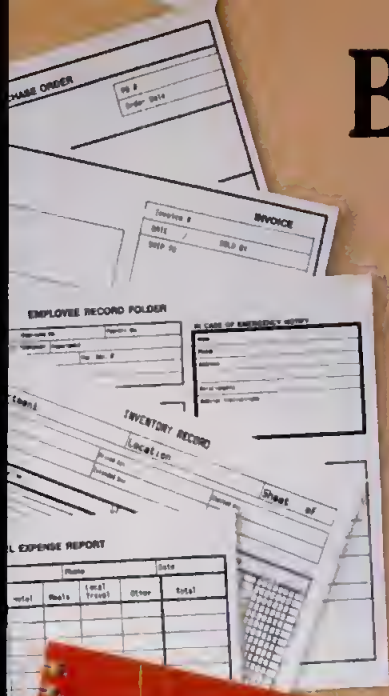
Reference File is a solid implementation of a good idea. Pop-up database availability is useful to anyone who has ever wished for more-convenient access to data files.

PC MAGAZINE FACT FILE

Reference File
Reference Software
330 Townsend St., #131
San Francisco, CA 94107
(800) 872-9933
(415) 541-0222
List Price: $89
Requires: 512K RAM, hard disk drive, DOS 2.0 or later.
In Short: The functionality of a flat-file database, available at the touch of a hotkey. Not copy protected.

CIRCLE 430 ON READER SERVICE CARD

Business Forms That Mean Business



Isn't it frustrating? You need all kinds of forms to run your business. With a PC on your desk, why are you still doing forms by hand? Now with **FormWorx,™** and **FormWorx with Fill & File,™** you have two ways to streamline your forms processing. Save time. Save money. Get down to business.

FormWorx.™ Get the forms you want. Invoices, expense reports, tracking sheets, records, logs, and schedules. Whether it's a form you use a thousand times or a one-of-a-kind, you can make it with **FormWorx.** Start from scratch or modify one of the many forms we've already created for you.

Business forms that look business-like. Draw vertical and horizontal lines —single, double, and thick—with just a single keystroke. Lines print perfectly straight and solid on dot matrix and laser printers. Type and edit text. Large, wide, and condensed type sizes. Underline, boldface, center, justify, reformat, alter case, and more.

It's easy to change your mind. Stretch or shrink a form. Erase, copy, and move things around until every detail is just right. Sort and resort a list, search for a word, etc. There's even an "Undo" command for those times when the computer does what you say instead of what you mean.

The fastest and easiest forms generator on the market. Period. Intuitive pull-down menus and clear commands allow you to create your first form soon after opening the package. It's that simple

NEW! FormWorx with Fill & File.™ Fill out forms perfectly.
All the features of **FormWorx** *plus* powerful **Fill & File** software that lets you easily fill out the same form again and again. Perfectly. Standard government and industry forms. Armed forces, real estate, insurance, health care, law, education,...

Form template shows on screen for easy fill-in. Simply tab from one blank to another and just type. Your typing stays in the blanks and the form is protected against accidental overwrites. Easily edit your entries and get letter-perfect printouts every time.

Lets you print only the data onto pre-printed forms. Perfect alignment every time. Or if you prefer, print the form and the data onto blank paper. Either way, you can use search conditions to batch print only those forms you need.

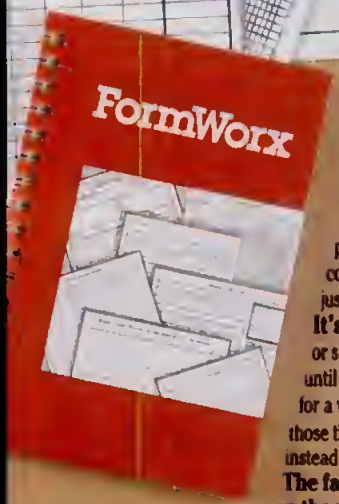
Minimizes retyping. "Lookup" lists help you type frequent entries automatically. "Ditto" repeats what you typed before. Date, time, and serial number "stamps" will save you precious time. And fixed data can be preserved in "Read-only" fields.

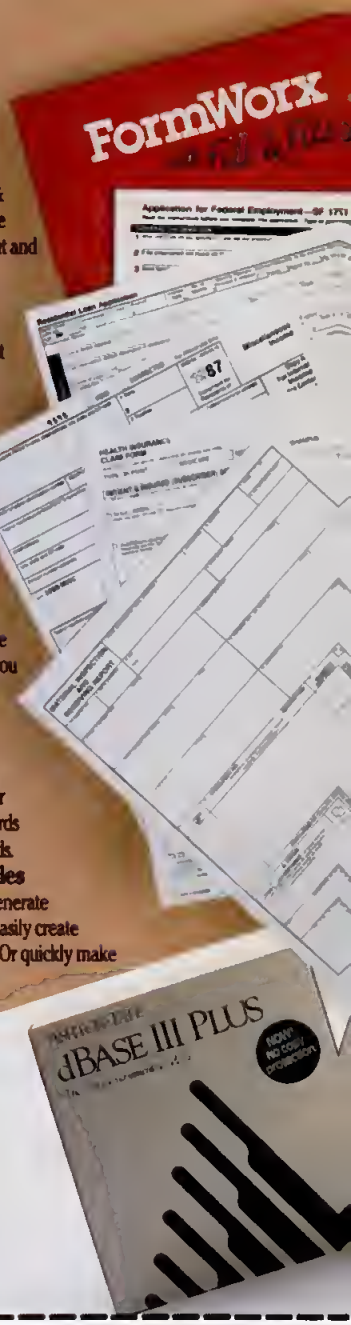
Stores data in a database file for later use. Just retrieve the information whenever you need it for that form...or any other form. Store up to 32,000 records in a single file. Easily locate and update specific records.

Reads and writes dBASE III Plus™ (.DBF) files directly so the data on your forms can be used to generate reports, summaries, mailing labels, form letters, etc. Easily create a form for loading information into your dBASE files. Or quickly make a form for viewing selected information in those files. ASCII and other file formats are also supported.

Fill & File even does the math!

Included free: FormWorx Programming Language. Automates forms processing in your office.





The critics are unanimous:

"FormWorx makes it easy to create forms. Inexpensive...easy to use." **The Wall Street Journal.**

"The user interface is first rate. Editing is especially easy. The documentation is well written, comprehensive, and easy to understand." **PC Magazine.**

"This program simply does a beautiful job." **PC Week.**

And users agree:

*"A great product is only half the story. You folks at FormWorx also have that ingredient which is missing with so many products on the market today—**customer service.** You take care of your customers like few in the industry do today—and the customers keep coming back with their friends!"* **R.D.W., Lexington, S.C.**

In Mass. 617-890-4499

FormWorx

Reservoir Place, 160t Trapelo Road, Waltham, MA 02154

Hardware requirements. Over 125 printers supported. Requires IBM PC, PS/2, or compatible with DOS 2.0 or higher. FormWorx—320 KB. FormWorx with Fill & File—512 KB. Works with or without a graphics board. Color is displayed on color systems. Available on 3.5" disks when specified. Not copy protected.

Prices and terms subject to change without notice. Trade-up rebate offer expires June 30, 1988. FormWorx and Fill & File are trademarks of FormWorx Corporation. dBase III Plus is a trademark of Ashton-Tate

CIRCLE 174 ON READER SERVICE CARD

Special Offer! **FormWorx** is just **$95.*** **FormWorx with Fill & File** is just **$149.*** Each package includes dozens of ready-to-print forms, an easy-to-read manual with tutorials, and **FREE** telephone support.

Yes! Send me ☐ **FormWorx** ☐ **FormWorx with Fill & File**

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Card no. _____ Expires _____

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☐ Enclosed is my check or money order.

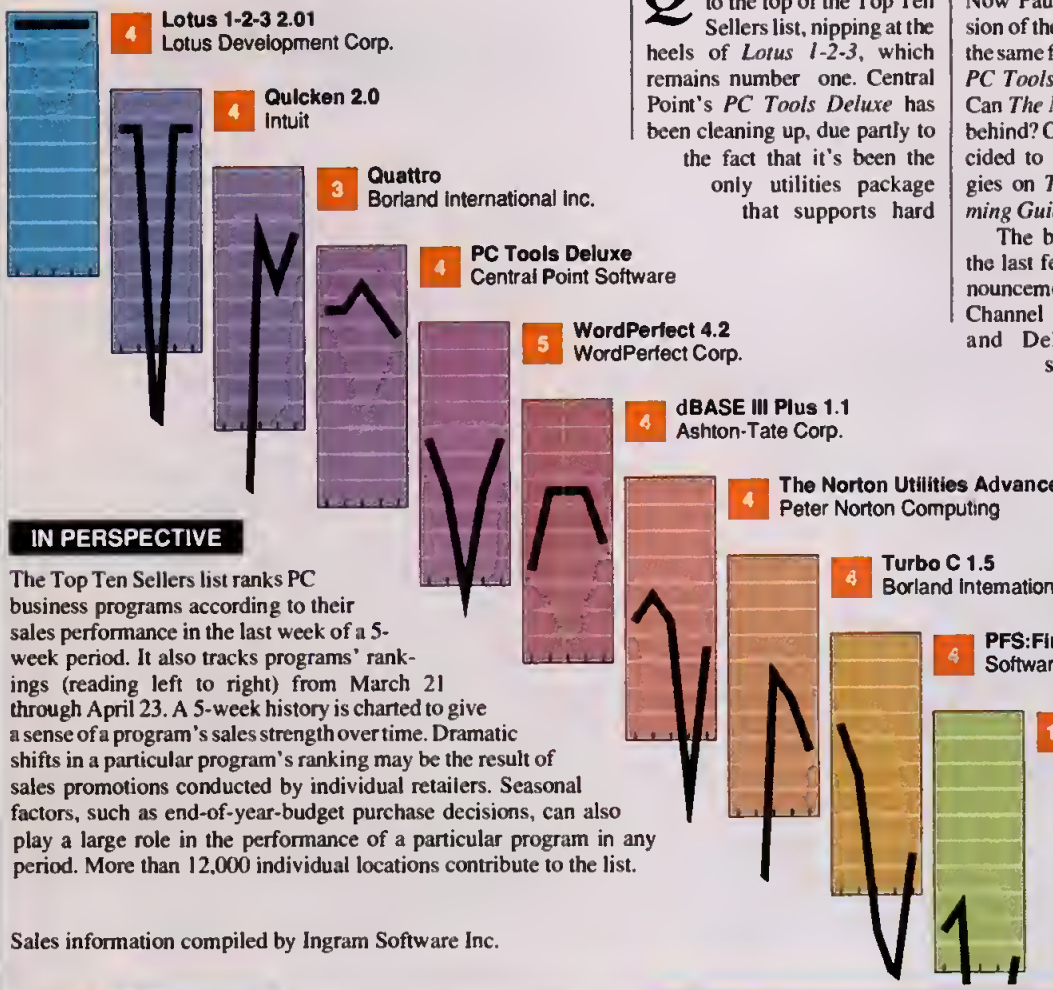
Make checks payable to **FormWorx Corp.** Shipping and Handling in US/Canada. **FormWorx**—$4.75, **FormWorx with Fill & File**—$6.75. Air mail overseas: **FormWorx**—$10. **FormWorx with Fill & File**—$18. In MA add 5% sales tax.

45-Day Money Back Guarantee! If for any reason you are not satisfied, call our customer service department to arrange for a prompt refund. Direct purchases only.

PC MAGAZINE PIPELINE

TOP TEN SELLERS

(A 5-week history)



4 **Lotus 1-2-3 2.01**
Lotus Development Corp.

4 **Quicken 2.0**
Intuit

3 **Quattro**
Borland International Inc.

4 **PC Tools Deluxe**
Central Point Software

5 **WordPerfect 4.2**
WordPerfect Corp.

4 **dBASE III Plus 1.1**
Ashton-Tate Corp.

4 **The Norton Utilities Advanced Edition**
Peter Norton Computing

4 **Turbo C 1.5**
Borland International Inc.

4 **PFS:First Publisher**
Software Publishing Corp.

10 **PFS:First Choice 2.0**
Software Publishing Corp.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

Sales information compiled by Ingram Software Inc.

IN PERSPECTIVE

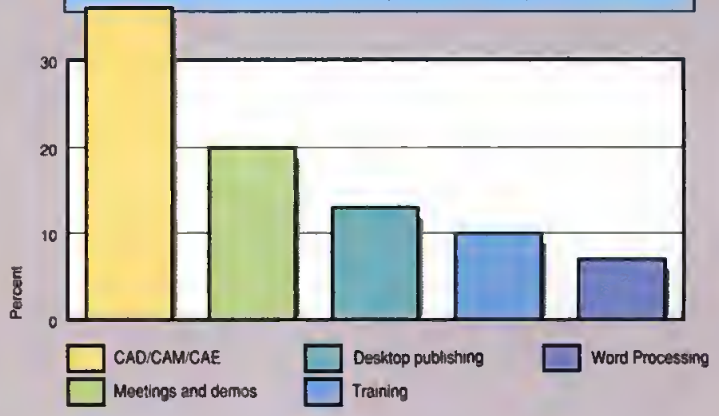
The Top Ten Sellers list ranks PC business programs according to their sales performance in the last week of a 5-week period. It also tracks programs' rankings (reading left to right) from March 21 through April 23. A 5-week history is charted to give a sense of a program's sales strength over time. Dramatic shifts in a particular program's ranking may be the result of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year-budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Quattro continues its climb to the top of the Top Ten Sellers list, nipping at the heels of *Lotus 1-2-3*, which remains number one. Central Point's *PC Tools Deluxe* has been cleaning up, due partly to the fact that it's been the only utilities package that supports hard disks beyond the 32MB barrier. Now Paul Mace's newest version of the *Mace Utilities* offers the same feature, and it may give *PC Tools* a run for its money. Can *The Norton Utilities* be far behind? Or has Peter Norton decided to concentrate his energies on *The Norton Programming Guides for OS/2*?

The big hardware news of the last few weeks was the announcement of the first Micro Channel clones. Tandy Corp. and Dell Computer both scrambled to be the first to announce, with Dell beating out

PC MAGAZINE SURVEY

What's the primary use for 19-inch or 20-inch monitors in your company?



Our latest survey shows big monitors are gaining popularity on corporate desktops. Formerly used mostly with CAD/CAM and other workstation-style applications, 19- and 20-inch displays are enjoying a new role as desktop publishing tools.

Programs like *PageMaker* and *Ventura Publisher* are tailor-made for big, high-resolution screens that can display full WYSIWYG pages for layout and design. But they're still not seen as necessary for general business tasks like word processing or spreadsheet work. Perhaps as prices fall, big monitors will infiltrate everyday applications, too.

Tandy by 3 days.

Of course, *announce* is the key word here. There's no telling when the machines will actually ship. Tandy says July for its $6,499, 20-MHz Model 80 killer, and Dell, which has yet to quote prices, is predicting fourth-quarter availability of its Dell System 500, also equipped with a 20-MHz 386 processor.

PS/2 Clones by Fall?

Why does July sound optimistic? One reason is the problems Intel's reportedly having with PS/2 chip sets. A source inside the company says customer deliveries will be rolled back until at least August, maybe September. That makes July shipments of finished machines doubtful.

Is it too long to wait? Will IBM's foothold have become so strong by the fall that the clone's chance of success will be diminished? IBM's claim of shipping 2 million PS/2s is often criticized by observers who believe that about 60 percent of that 2 million consists of the standard-bus Model 25 and Model 30 and the midrange Model 50. Even so, that leaves about half a million MCA-bus machines, a hefty number by anyone's reckoning.

Compaq has been conspicuously silent through all of this. But just recently, a reporter asked the company's marketing czar, Mike Swavely, if he could identify the biggest problem in making an MCA-compatible PC. "There are no major problems," Swavely said.

> Fall delivery dates for Micro Channel clones may be optimistic if the reported delays on Intel PS/2 chips are real. By then, IBM may have gained a strong enough foothold in the PS/2 market to ward off intruders.

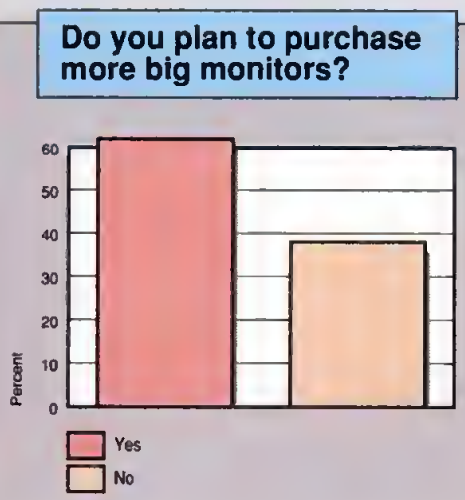
Now that IBM has said that it is willing to license the Micro Channel patents it has so jealously guarded, the only thing keeping MCA clones from being marketed is a sign of strong demand. A modest demand just won't be enough to get production lines geared up, because IBM will sock manufacturers for up to 5 percent of their sales revenue if they use more than one IBM patent in a system. (IBM will ask for only 1 percent if just one patent is licensed.) IBM has said it now holds, or has applied for, more than 100 patents on PS/2 components.

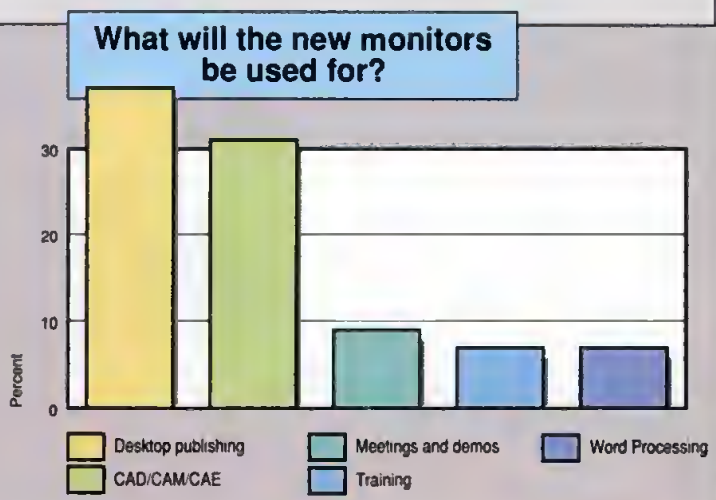
And compatible makers will still have to ante up to Computer Automation, the company that claims to have invented the auto-configuring scheme used in PS/2s (IBM says that it developed the system on its own but did license Computer Automation's technology just to avoid possible lawsuits). Computer Automation will ask for royalties from the manufacturers of both MCA add-in boards and complete systems that will tack on about $15 to the cost of a board and $40 to the cost of a system.

Can Dell, Tandy, and the others that will undoubtedly join the ranks of PS/2-compatible manufacturers make any money off these machines? Both companies have full lines of standard-bus machines to support, so their MCA clones have to be more expensive than the regular line. That means no deep discounts on the PS/2 machines. By the time everything's added up, they may not be able to offer PS/2 clones for much less than the "real thing." And the Micro Channel is still so little understood that corporations might be leery of straying from the IBM fold when it comes time to change buses.

The March 29, 1988, edition of Pipeline reported on Advanced Micro Devices' inability to deliver 16-MHz 80286 chips in volume. At the time, we wondered whether AMD's troubles, coupled with Intel's emphasis on 386 technology, would sound the death knell for the 286. Since then, however, Harris Systems has come forth to carry the 286 torch. The mainframe and systems maker is OEMing 286-based PCs to Dell Computing (see First Looks, page 33, *PC Magazine*, June 14, 1988), Trillian, and others. Looks like there's still life before 386 after all....

—Nora Georgas and Gus Venditto

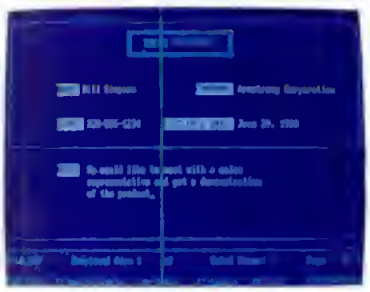






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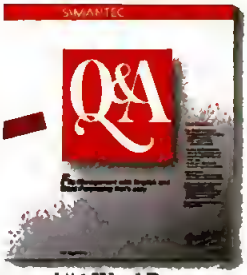


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CIRCLE 745 ON READER SERVICE CARD

File Transfer Programs Bridge The Gap Between DOS and Mac

PC HANDS ON

BY DONALD B. TRIVETTE

Transferring files between an Apple Macintosh and an IBM PC has always been vexing, but now two products make connectivity a breeze. One is controlled from the Macintosh, and the other takes its orders from the PC. Both do a good job of translating ASCII files, but neither can do anything about translating the Mac's splendid graphics to run on IBM software, since there is no graphics standard for the PC.

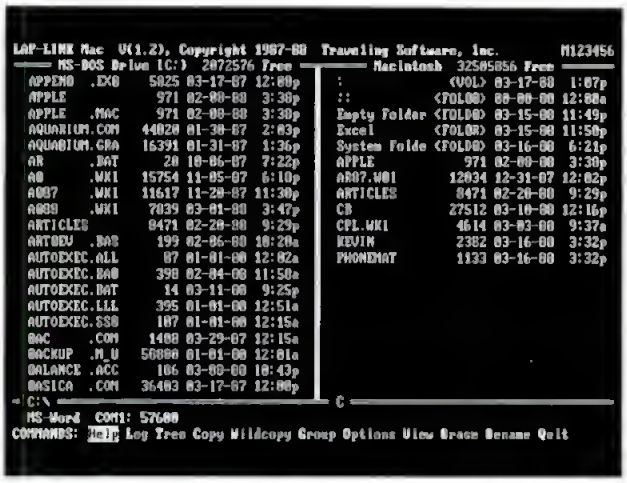
QuickShare, from Compatible Systems, is part hardware and part software. A board installs in one of the PC's expansion slots and connects to the Mac's SCSI port by an included 10-foot cable. The software transfers files between the machines and creates a virtual disk on the PC.

The Macintosh treats the *QuickShare* board in the PC as an external hard disk, so the installation software can configure a portion of the PC's real hard disk—or RAMdisk—to create a virtual drive that can be accessed by the Macintosh. The virtual disk can even be the Mac's boot disk, provided that the PC is up and running.

Although the space is physically located on the PC, it appears to the Macintosh as its own and is addressed by an icon that looks like the face plate of a PC hard disk. The PC sees the space as a large DOS file, but a file that it can neither read nor write, because a Mac and a PC have entirely different disk formats. The virtual disk can be as large as you and DOS will allow a file to be. If the Mac already has an internal hard disk, the virtual disk becomes a second hard disk. It's a nifty trick that works well.

The file transfer part of the software, PC Transfer, has a separate Macintosh icon of an IBM PC. Double-clicking this icon causes a split screen to appear on the Mac, showing DOS files in the left window and Macintosh files in the right window. Mark the file or files you want to transfer, and then click the box located between the two windows; the transfer takes place at either 1.4 or 4.2 million bits per second, depending on the Macintosh model you're using. You can't select an entire (PC) subdirectory or (Mac) folder for transfer; you have to select files individually. The transfer program is initiated and controlled from the Macintosh.

QuickShare performs PC-to-Mac conversions on word processing files using a unique process. You use your word processor to print a document, but a memory-resident program on the PC grabs the output and converts things like boldfacing, centering, and underscoring to Macintosh formats, and then saves the print file to disk. By converting the print image rather than the source text, the software doesn't need to know which software created the output. *QuickShare* does not perform Mac-to-PC conversions.



Lap-Link Mac displays DOS files on the left and Macintosh files on the right. transferring files between machines is as easy as highlighting a file and pressing "C."

Lap-Link Mac

Lap-Link Mac is the latest product from Traveling Software, the developer of *Lap-Link*, which transfers files from one PC to another.

Lap-Link Mac comes with a truly universal 8-foot cable to connect the two computers. This four-headed Medusa has a 9-pin and a 25-pin connector on the PC side, and a round D-shell connector for the older Macintosh 128 and 512, along with a round connector needed for the Mac SE, Plus, and II.

Once the two machines are connected, software does the rest. *Lap-Link Mac*, which is run and controlled from the PC, displays a split screen with DOS files on the left and Macintosh files on the right. The program can transfer an entire subdirectory from the PC to the Mac with a single command, but it cannot carry out the opposite process from a Macintosh folder to a PC subdirectory.

Software products like *WordPerfect*, *PageMaker*, and *Microsoft Word*, *Works*, and *Excel* have versions that run on both the PC and the Macintosh. A common data format lets files created on one machine be used with the sister software without translation. An options menu on *Lap-Link Mac* can set the "creator" switch for these files as they are transferred, so that double-clicking the file—a concept unique to the Mac—causes the correct application to start.

Lap-Link Mac has four speed settings ranging from 9,600 to 57,600 bps. It also has settings to perform carriage-return/line-feed and ASCII conversions.

Lap-Link Mac is the easiest to install and does not take a dedicated expansion slot. It has the most-powerful file selection options and costs less than *QuickShare*. But *QuickShare* can give you a virtual hard disk, and with Mac hard disk prices starting at about $700, that can be a valuable consideration. PC

PC MAGAZINE FACT FILE

QuickShare
Compatible Systems Corp.
P.O. Drawer 17220
Boulder, CO 80308
(800) 356-0283
List Price: $465
Requires: Apple: Macintosh Plus, SE, II, or 512E with SCSI port. IBM: PC or compatible (not PS/2 Micro Channel bus) with 256K RAM, expansion slot, DOS 3.0 or later.
In Short: A file transfer program controlled from the Macintosh keyboard. A unique process lets you translate most PC word-processing files to the Macintosh format, but not the reverse. Not copy protected.

CIRCLE 431 ON READER SERVICE CARD

Lap-Link Mac
Traveling Software Inc.
19310 N. Creek Pkwy.
Bothell, WA 98011
(206) 483-8088
List Price: $139.95
Requires: Apple: Macintosh. IBM: PC, XT, AT, or PS/2 or 100 percent compatible; 128K RAM, serial port; DOS 2.1 or later.
In Short: A file transfer program that has a range of ways to pick files for transfer and an option to set the file "creator" switch. Not copy protected.

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CIRCLE 206 ON READER SERVICE CARD

Directory Assistance for File Management

PC HANDS ON

BY JENNIFER ZAINO

Individual Software's *Directory Assistance* provides a fast and friendly way to manage your system files. The program can be run in memory (where it takes up about 160K) or non-memory-resident mode.

Directory Assistance features separate tree, file, status, and command menu windows. Not all of *DA*'s features have to be accessed via the menu commands, though—functions such as marking and unmarking files, switching windows, and help screens can be brought up with function keys.

The program will be especially appreciated by the novice user. A disk-based tutorial takes you by the hand and guides you gently through the basics of DOS. (You risk having your system freeze up if you don't unload *DA* from memory before running this, though.) Help is also available from over 300 context-sensitive help screens. Other protective measures, such as being unable to format the drive you are working on or your hard drive, are clever safeguards for new users and old hands alike.

Directory Assistance contains most of the features users have come to expect in a DOS shell: file password protection and tagging, sorting, comparing, and renaming files and directories. The Move and Copy commands are especially speedy—you can perform these operations on multiple files and directories almost as quickly as you can on just one.

The View command lets you see your files in either text or hex mode, but it currently lacks an editing feature. *Directory Assistance* is also unable to display document files created by some word processors in text mode and will automatically default to hex.

One of the program's more-interesting features is its Showall display, which lets you view all your files, even hidden ones, as if they were in a single directory. When used with the FileMatch command, it provides a quick way to locate any of your files. A separate, nicely implemented Find feature even lets you search for files for a specific string of text.

A Remember utility provides you with shortcut alternatives to some tedious typing. For instance, the GetPath command will let you save a path name to use whenever *Directory Assistance* prompts you to "type in a path name and press enter." It works fine, although you shouldn't rely on the manual's directions to get it going.

Directory Assistance couldn't be easier to learn or use. Whether you're new to the world of DOS or an experienced DOS devotee, you'll find it can help you get many of your system management tasks done quickly and effectively. PC



Directory Assistance *prevents you from formatting your system's hard drive.*

PC MAGAZINE FACT FILE

***Directory Assistance*, Version 1.1B**
Individual Software Inc.
125 Shareway Rd., #3000
San Carlos, CA 94070-2704
(800) 331-3313
List Price: $59.95 (includes 3½- and 5¼-inch disks).
Requires: 256K RAM, one disk drive, DOS 2.1 or later.
In Short: A DOS shell that is easy to use and can be run in memory-resident or non-memory-resident mode. Not copy protected.

CIRCLE 436 ON READER SERVICE CARD

Pacesetter 386 Offers Easy Upgrade

PC HANDS ON

BY WINN L. ROSCH

If your old AT pales when compared with the 80386 horsepower now available, CompuSystems can whip its slow trot up to a fast canter. The South Carolina medical systems supplier offers its own design for an 80386-based system board upgrade for ATs in the guise of the Pacesetter 386.

Though not quite up to the galloping front-runners that use exotic caching techniques, the top-of-the-line $2,695 Pacesetter 386 turns in showy performance with its 20-MHz clock and two-way memory interleave, outdistancing Compaq's original Deskpro 386 by 20 percent. When you need to take a breather, you can slow its gait to 8 MHz, as you can with its stablemate, a $2,195 16-MHz model.

Up to 8MB will fit into the eight SIMM sockets on the board. The sockets accept either 256K or 1MB SIMMs in banks of four. Standard memory is 1MB (256K SIMMs), of which 640K is devoted to DOS, the rest to shadowing ROM.

Expansion slots match the AT standard: two 8-bit, six 16-bit. No 32-bit expansion is available. The bulk of the circuitry is contained in the Chips and Technologies 386 chipset.

All AT-style system board connectors are present in roughly their AT positions, except for battery jacks. The Pacesetter includes its own on-board rechargeable nickel cadmium battery that's good for 6 to 10 years' use without replacement.

CompuSystems brings the somewhat stiff price closer to bargain status by offering a $700 trade-in on your old IBM PC AT system board, $500 for American-made compatibles, and $300 for offshore clones. If you're not afraid of half an hour of simple mechanical work, a system board exchange like the Pacesetter 386 is the best way to perk up the performance of your old gray AT. PC

PC MAGAZINE FACT FILE

Pacesetter 386
CompuSystems Inc.
7130 Fire Lane Rd.
Columbia, SC 29223
(803) 736-0673
List Price: 16-MHz board with 1MB RAM, $2,195; 20-MHz board with 1MB RAM, $2,695.
Requires: IBM PC AT or compatible, DOS.
In Short: A replacement system board designed for ATs that injects 16 or 20 MHz. Yields 80386 performance with two-way interleaved memory.

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Tandon's Pac 286 Plus: 10-MHz Speed, Removable Hard Disks in a Compact Box

PC HANDS ON

BY MITT JONES

The Tandon Pac 286 Plus would be an eye-catching item even if 10-MHz speed, low cost, and compact design were all it had going for it.

Measuring about the size of a small-footprint PC, the $3,199 Pac 286 Plus includes all the makings of an AT—including four full-length 16-bit slots and one 8-bit slot, a socket for an 80287 coprocessor, and built-in serial and parallel ports. One megabyte of RAM comes on the system board, and an optional daughterboard allows an additional 4MB. Add Tandon's removable hard disk technology, and you've got a machine that offers advantages few other systems can boast.



The Pac 286 Plus sports two receptacles for Tandon's 30MB removable hard disks, which are called Personal Data Pacs. The optional 5¼-inch floppy drive (shown) attaches to the system chassis.

The Pac 286 Plus holds two removable hard disks—Tandon's shock-mounted, 30MB Personal Data Pacs—with receptacles built in to the front of the system. You slide the Data Pac into one of the receptacles until it stops. A motorized loader takes over from there.

Once up and running, the system delivers impressive hard disk performance. The $399 Data Pacs themselves use slow, band-stepper actuators, but an RLL controller with a 128K hardware disk cache gives the throughput you'd expect with an expensive, 40-millisecond hard disk. For instance, PC Labs benchmark tests showed the disk in the PS/2 Model 60 to have a much faster access time, but actual throughput was close. The Pac 286 Plus completed a battery of small-record file-access tests in 68 seconds and similar large-record tests in 12 seconds. Without IBM's cache installed, the Model 60 completed the same tests in 72 seconds and 10 seconds, respectively.

Despite its impressive speed and features, the Pac 286 Plus is not without its problems, however. First and foremost, Tandon has attempted to cater to inexperienced users with a series of setup menus that may end up causing much more trouble than they are worth. To deactivate one particular menu, for instance, you must get to the main setup menu. The installation documentation leads you through how to use this setup menu, but not how to access it.

Tandon also replaced the familiar FORMAT and FDISK commands for hard disks with two new sets of commands—one set for standard hard disks and one set for Personal Data Pacs. This is sure to annoy any long-term DOS user.

Overall, however, I like the Pac 286 Plus. The machine is well built and mercifully compact, and the Personal Data Pacs afford many luxuries, such as unlimited storage potential and extremely fast backup from one Pac to another. PC

PC MAGAZINE FACT FILE

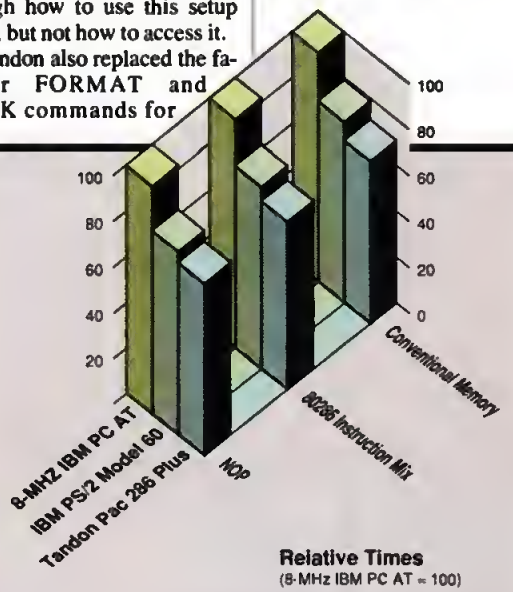
Pac 286 Plus
Tandon Corp.
405 Science Dr.
Moorpark, CA 93021
(805) 523-0340
List Price: Pac 286 Plus (main unit and keyboard only), $3,199; 30MB Personal Data Pac, $399; EGA card and monitor, $849.
In Short: An unusual-looking but high-quality 80286-based machine that features removable hard disk drives.

CIRCLE 450 ON READER SERVICE CARD

PC LABS: Tandon Pac 286 Plus vs. 8-MHz IBM PC AT and IBM PS/2 Model 60

The 10.7-MHz Tandon Pac 286 Plus outperforms the IBM PS/2 Model 60 in every category except hard disk performance (results not shown). The Pac 286 Plus uses Tandon's removable Personal Data Pac hard disks—85-millisecond drives with RLL controllers. Run with Tandon's disk-caching utility, however, the Personal Data Pacs shouldn't hinder the system's impressive overall speed too severely.

Performance Times (Times given in seconds)	NOP	80286 Instruction Mix	Conventional Memory
8-MHz IBM PC AT	4.2	9.0	1.3
IBM PS/2 Model 60	3.4	7.1	1.0
Tandon Pac 286 Plus	3.2	6.6	0.9



The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **80286 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80286 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.



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FREE SOFTWARE OFFER
See Page 208 for details

There's also *Findfile* for locating files by name or wildcard anywhere on your disk. *Sorts* for rearranging files and directories in a way that makes sense to you. *Lock* and *UnLock* for password protected file security. For permanent erasure of sensitive data, there's *Killfile*. And lots more.

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- Western Digital 2F-2H Controller
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- 1 - 32 Bit Slot

20MHz Model 386-5 with Intel 20MHz 80386

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- AT and OS/2 Compatibility
- 200 Watt Power Supply
- 80287 or 80387 Coprocessor
- 1 - 32 Bit Slot.

Model 286-1 12MHz

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- 80286 Running at 12MHz and 0 Wait State
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- 1.2MB Floppy Disk Drive
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- 200 Watt Power Supply
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Model 386-7 24MHz

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CIRCLE 390 ON READER SERVICE CARD

NEW ON THE MARKET

by Michael W. Muchmore

Trillian Introduces an AutoCAD Workstation That Runs at 9 MIPS

The UnixSystems division of **Trillian Computer Corp.** has introduced an *AutoCAD* workstation containing a 33-MHz, 32-bit RISC chip from Clipper and a 20-MHz 80386 chip. The US9000 runs DOS 3.3 and Unix System V.3 simultaneously to provide a turnkey *AutoCAD* workstation that churns out 9 million instructions per second. The user takes advantage of the speed gained by running under Unix but the system acts as if it were running under DOS.

The $23,995 US9000 runs *AutoCAD* three to five times as fast as does a 20-MHz 80386-based system. It has a 70MB hard disk, a 5¼-inch floppy drive, a 60MB tape drive, and a 19-inch 1,280 by 1,024 monochrome monitor. Larger hard disks and a color monitor (1,280 by 1,024 with 256 simultaneous colors out of a palette of 16.7 million) are optional.

List Price: US9000, $23,995.

Trillian Computer Corp., UnixSystems Div., 372 Turquoise St., Milpitas, CA 95035, (408) 942-1791.

CIRCLE **443** ON READER SERVICE CARD

Two Companies Ship PostScript Controllers For LaserJet Printers

Two companies, **Imagen Corp.** and **Conographic Corp.**, are shipping solutions to printing PostScript documents in PC compatibles on LaserJet and other Canon CX- and SX-based printers.

Imagen's PC Publisher Kit consists of a controller add-in board and software. The kit comes in two versions, which are both priced at $1,895. The company says the Kit supports more printer control languages than competing products, with Imagen's DDL, Adobe's PostScript, Hewlett-Packard's PCL, and (for $100 extra) HPGL supported.



Output sample produced with ConoDesk 6000, Conographic's PostScript-emulating controller.

Imagen has licensed the kit's 35 typefaces from the same sources as Adobe, such as Linotype for the well-known Times Roman and Helvetica fonts. It claims to be the only firm that can claim this exact duplication of the Adobe fonts.

The kit runs in AT compatibles and can output to other printers including Diablo, Epson, and IBM.

Conographic touts printing speed as the crux of its ConoDesk 6000 controller—up to 25 percent faster than Apple's LaserWriter. The single-slot board for XT and AT compatibles has a proprietary 32-bit processor and 2.5MB of DRAM.

ConoDesk 6000 can be optimized for a dedicated PC (as opposed to one on a LAN), or for printing encapsulated PostScript files. The first is called PersonalScript mode, the second ConoScript mode. It can also bypass PostScript and print directly from *Ventura Publisher*, *PageMaker*, or *Microsoft Windows*.

List Price: Imagen PC Publisher Kit, $1,895; HPGL support, $100.

Requires: IBM PC AT or compatible, Canon CX- or SX-based laser printer. Imagen Corp., 2650 San Tomas Expwy., P.O. Box 58101, Santa Clara, CA 95052-8101; (408) 986-9400.

CIRCLE **441** ON READER SERVICE CARD

List Price: Conographic ConoDesk 6000, $2,995; I/O adapter for SX-based printers (series II), $150.

Requires: IBM PC-XT or AT, or compatible; Canon CX- or SX-based laser printer. Conographic Corp., 16802 Aston, Irvine, CA 92714; (714) 474-1188.

CIRCLE **442** ON READER SERVICE CARD

PagePerfect Blends Desktop Publishing, Graphics, and Word Processing Functions

After almost a year of publicity, **IMSI** (International Microcomputer Software Inc.) has begun shipping *PagePerfect*, a desktop publisher that provides word processing, graphics, and file management.

PagePerfect imports most word processing files and lets you enter and edit text during page layout with *WordStar* or *MultiMate* commands.

Page composition features include nine zoom levels, multiple columns, style sheets, automatic text wrap, and automatic text generation. The package also creates gutters, rules, and boxes. You can open two windows simultaneously.

The WYSIWYG word processor in *PagePerfect* has a spelling checker and thesaurus, hyphenation and justification, and move, copy, delete, undo, goto, find/replace, and repeat commands. Eight restylable Bitstream fonts—in 11 sizes each—are included, and you can add hundreds more with Bitstream's *Fontware*.

In the graphics realm, *PagePerfect* provides an Image Librarian and a graphics editor. Images may be scanned, drawn, or imported as TIFF files. The Librarian lets you scroll through images and store captions together with images.

PagePerfect comes bundled with *Desktop Publishers Graphics*, an editor that provides pixel editing, resizing, gray-scale averaging, and contrast adjustment.

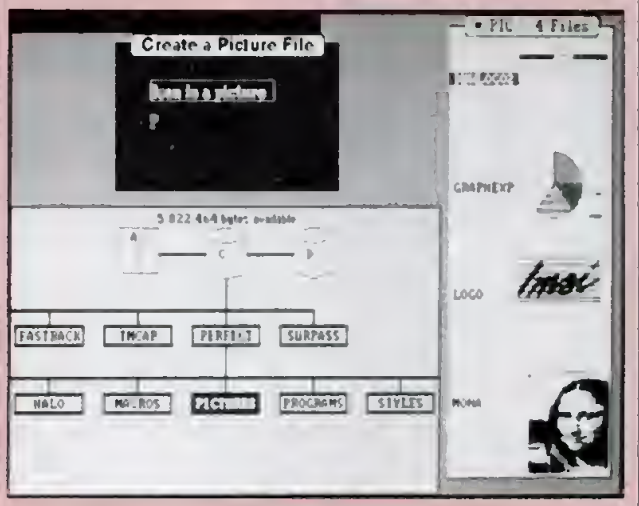
IMSI plans PostScript support for *PagePerfect*, but the product doesn't include the page description language yet.

PagePerfect's file management shell performs all DOS functions and has macros, help, and file tagging.

List Price: *PagePerfect*, $495

Requires: 640K RAM, hard and floppy disk drives, laser or 24-pin dot matrix printer. Microsoft-compatible mouse. DOS 3.0 or later. Not copy protected. IMSI, 1299 Fourth St., San Rafael, CA 94901; (800) 222-GRAF; (800) 562-GRAF (in Calif.).

CIRCLE **439** ON READER SERVICE CARD



IMSI's PagePerfect *is a $495 desktop publishing package that provides full-featured text editing, graphics editing, and file management.*

NEW ON THE MARKET

Small Workstations From ALR Offer 20-MHz 386, 286 CPUs

To complement its line of FlexCache servers, **Advanced Logic Research**, of Irvine, California, is offering FlexNode workstations. The computers take up only 4½ by 15 inches of desktop and are 7 inches tall. They accept 80286 or 80386 CPU plug-in boards that run at 20 MHz.

The FlexNodes feature zero-wait-state operation with paged interleave memory architecture, similar to that of the FlexCache systems. The 286 version starts with 512K expandable to 5MB, while the 386 has 1MB of 32-bit RAM expandable to 13MB. Both accept math coprocessors.

Storage is handled by the standard 3½-inch diskette drive and optional 30- and 50MB hard disks.

List Price: ALR FlexNode 286, $1,990; with 30MB hard disk, $2,549; with 50KB hard disk, $2,990. ALR FlexNode 386, $3,490; with 30MB hard disk, $3,990; with 50MB hard disk, $4,449. Advanced Logic Research Inc., 10 Chrysler, Irvine, CA 92718; (714) 581-6770.

CIRCLE **444** ON READER SERVICE CARD

HOT PROSPECT

Write on Portable's LCD Screen, Your Handwriting Becomes ASCII

Linus Technologies has combined a small, portable LCD screen with a clear glass digitizing surface on which you write with a penlike stylus. With the Linus, the first "write-top," your writing shows up as "electronic ink" on the 80- by 25-character liquid crystal display. The display can use external light or its own backlighting for illumination.

The 3-pound input screen is attached to the 6-pound system unit, which you can strap over your shoulder or place under an airplane seat.

Linus has also developed *Your-Write*, software that converts your handwriting into ASCII characters after you teach it all the ways you form each character.

To edit with Linus running its *Just-Write* word processor, you just cross out a letter or word if you want to delete it. You can also block text with the pen and delete, move, or copy it with one scrawled symbol.

Linus offers a software development kit, Code-Write, for creating write-top-compatible programs.

The system unit houses an 8088-compatible processor with 640K of battery-backed static CMOS RAM, a 3½-inch diskette drive, an optional modem, and a slot for a credit-card-size RAMcard that can contain up to 512K more RAM or 2 MB ROM. There are serial and parallel ports, a port for an external keyboard, and one for an external 5¼-inch floppy drive.

List Price: Linus, $2,400 to $3,600, depending on options. Linus Technologies Inc., 1889 Preston White Dr., Reston, VA 22091; (703) 476-1500.

CIRCLE **438** ON READER SERVICE CARD



Write on the Linus write-top with a lead pencil that doubles as a digitizer, and your handwriting or drawings will appear in electronic ink.

Mitsubishi Augments its Monitor Line with Diamond Scans and High-Bandwidth Units

The people who brought us the Diamond Vision displays that are seen in major-league baseball stadiums are now offering 14-, 16-, and 20-inch Diamond Scan monitors and two high-bandwidth 14-inch monitors for your desk.

Mitsubishi Electronics' Diamond Scan 14 is a 14-inch



color multiscanning monitor with a resolution of up to 800 by 600 pixels and a .31mm dot pitch. It works with EGA, VGA, Mac II, and other graphics adapters. Scanning frequencies are from 15.6 to 36 kHz horizontal and from 45 to 90 Hz vertical with a 30-MHz bandwidth. The monitor has a suggested retail price of $889.

The Diamond Scan 16 and the Diamond Scan 20 L are the first 16- and 20-inch auto-tracking high-resolution color monitors with microprocessor-controlled scan mode memory. The processor fine-tunes the display size and position for 20 mode settings.

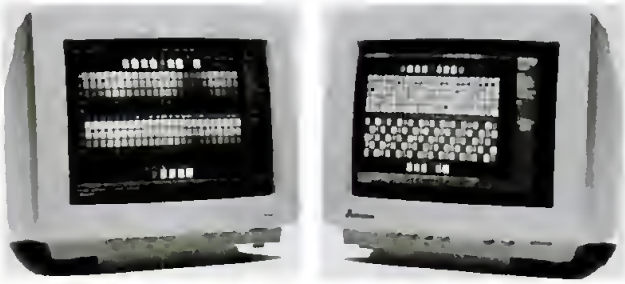
Both the $1,945 16-inch monitor and the $3,650 20 L support resolutions from 640 by 480 up to 1,280 by 1,024 with a dot pitch of .31mm. They have a 100-MHz bandwidth and 30- to 64-kHz horizontal and 50- to 90-Hz vertical scanning frequencies.

Mitsubishi is also unveiling its highest-resolution 14-inch monitors: the FA3415 and FA3425L9. The $1,015 FA3415 provides resolutions up to 850 by 600, and the $1,175 FA3425L9, which features long-persistence phosphors, gives you up to 1,024 by 768 pixels. Both have a dot pitch of .28mm. Scanning frequencies are 15.6 to 35.5 kHz horizontal and 50 to 87 Hz vertical. The monitors use a 40-MHz bandwidth in contrast with the usual 30 MHz.

Both FA monitors support most analog and digital graphics boards, while the FA3425L9 supports IBM's interlacing 8514A controller.

List Prices: Diamond Scan 14, $889; Diamond Scan 16, $1,945; Diamond Scan 20 L, $3,650; FA3415, $1,015; FA3425L9, $1,175. **Requires:** Graphics adapter (Diamond Scan 16 and 20 L require analog graphics adapter). Mitsubishi Electronics America Inc., Computer Peripherals Div., 991 Knox St., Torrance, CA 90502; (213) 515-3993.

CIRCLE **440** ON READER SERVICE CARD



New monitors from Mitsubishi include the $3,650 20-inch Diamond Scan 20 L (on top), the FA3415 (above right), and the high-resolution FA3425L9 (above left).

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CIRCLE 205 ON READER SERVICE CARD

Mach 20 Provides 80286 Power, Megamemory, a New Controller

PC HANDS ON

BY EDWARD MENDELSON

Your old PC can breathe a sigh of relief. Microsoft's Mach 20 enhancement board will quicken its pulse, expand its memory, and let it work with a mouse and a pair of high-density floppy disk drives. And a few months from now the Mach 20 will give it room to graze in the brave new world of OS/2. The Mach 20 does all this while occupying only one expansion slot.

The Mach 20 is a multifunction system that comes in three separate boxes. You can buy one or more depending on your needs and budget. The heart of the system, the unadorned Mach 20 itself, is a $495 8-MHz 80286 turbo board engineered to rival or exceed the performance of most 12-MHz turbo boards. This board is a half-length card with a socket for a 5- or 8-MHz 80287 coprocessor, a port for a Microsoft bus mouse, and connectors for the two optional add-on cards that make up the complete system.

The larger add-on is the $395 Memory Plus option, which has 512K RAM and can hold up to 3.5MB. This option connects to one end of the half-length Mach 20, extending it into a full-length board that has megamemory, a mouse port, and an 80286 processor.

With all this, there's still room for one more option, the $99 Disk Plus. This is a tiny daughtercard that nestles into the Mach 20 and replaces the PC's floppy disk controller.

The Disk Plus lets you run any pair of 360K, 720K, 1.2MB, or 1.4MB drives.

The Mach 20 was designed for Microsoft by the Personal Computer Support Group (PCSG), maker of the Breakthrough series of 80286 turbo boards. To hold down the price of the board, Microsoft put an 8-MHz cap on the clock. But PCSG's design flies faster than any other 8-MHz board tested in PC Labs. On some benchmark tests, it measures better than an 8-MHz PC AT. The board includes 16K of cache memory, and this cache gets an extra burst of speed from its 16-bit data bus—twice the width of the bus on a PC.

When you plug the Memory Plus option into the Mach 20, you're adding RAM that also uses a 16-bit data bus. So at the same time that the 8-bit memory on the motherboard gets a boost from the 16-bit cache, the Mach 20's add-on memory sends data through a 16-bit bus like that on an AT.

The 512K RAM that comes with the Memory Plus can be upped to 1.5MB using standard 256K chips with a speed of 150 nanoseconds or better. Further expansion to 3.5MB requires 1-megabit chips.

All Mach 20 memory above the 640K mark is configured as LIM expanded memory when you're running DOS. The board supports the faster task switching and greater flexibility of the new LIM 4.0 specification, and it adds extra speed by supporting multitasking in hardware rather than software. When you run the special Mach 20 version of OS/2—due this summer at a list price of $325—all memory above 1MB is configured as AT-style extended memory.

If you want to run OS/2 on a PC or XT, the Mach 20 is the only road guaranteed to take you there.

You'll need to buy a high-density disk drive before you can boot up any version of OS/2. You can probably use a new drive even if you plan to stick with DOS. If you want to exchange disks with PS/2 machines or laptops, plug the Disk Plus option into the Mach 20 and hook it up to a 1.4MB 3½-inch disk drive, obtainable from most mail-order houses. Don't be disturbed by the chugging noise your drives make when you boot up. The Disk Plus needs to check out each drive to determine its type, but the noise subsides by the time the DOS prompt appears on-screen.

You'll have to set half a dozen jumpers on the Mach 20 before installing it, but Microsoft gives you an excellent setup program that examines your system, asks a few question, and displays the proper jumper settings in larger-than-life diagrams. The disk includes a program for changing speeds from the keyboard at any time, and the same SMARTDRV disk cache that comes with *Windows*. But surprisingly, Microsoft doesn't include a RAMdisk; if you want one, you'll have to dig it up by yourself. DOS's VDISK won't work in the Mach 20's expanded memory, and you can't reconfigure the expanded memory into extended memory unless you're running OS/2.

The Mach 20 packs more functions into one board than anything else on the market, and it's a solid platform for OS/2. But if you're hungry for speed and aren't ready to rush into OS/2, you should consider a 80386 expansion board like the Intel Inboard 386/PC or the Quadram Quad386XT. (See "The Transformers: 386-based Turbo Boards for XTs," *PC Magazine*, April 12, 1988). OS/2 support for these boards is possible but not certain. Each board runs twice as fast as the Mach 20. Each comes with 1MB RAM, occupies a single slot, and costs $995.

For the same $995, Microsoft offers a package that combines the Mach 20, the Memory Plus option with 512K, and a copy of Microsoft's memory-hungry *Excel*. The normal list price for *Excel* alone is $495. For owners of five-slot PCs stuffed with video cards, hard disk cards, and I/O cards—and too slow to run *Excel* without a speed infusion from an 80286—this combination could prove irresistible. PC

Finding a RAMdisk for the Mach 20

Microsoft doesn't give you a RAMdisk to use in the Mach 20's LIM expanded memory, but you don't have to look far to find one that works well with this board. If you already have a multifunction board in your PC, try the RAMdisk that probably came with it. Orchid's and Quadram's will work; AST's and Tall Tree's won't. *Microsoft Windows* comes with an EMS RAMdisk called RAMDrive; the only documentation for it is on-disk.

You can also download a $15 shareware RAMdisk from the PC Magazine Interactive Reader Service. Look for NJRAMD.ARC in the shareware section. This well-designed disk needs only a tiny chunk of conventional DOS and has an access time that's twice as fast as DOS's VDISK.

—Edward Mendelson

PC MAGAZINE FACT FILE

Microsoft Mach 20
Microsoft Corp.
16011 NE 36th Way
Box 97017
Redmond, WA 98073-9717
(800) 426-9000
(206) 882-8080

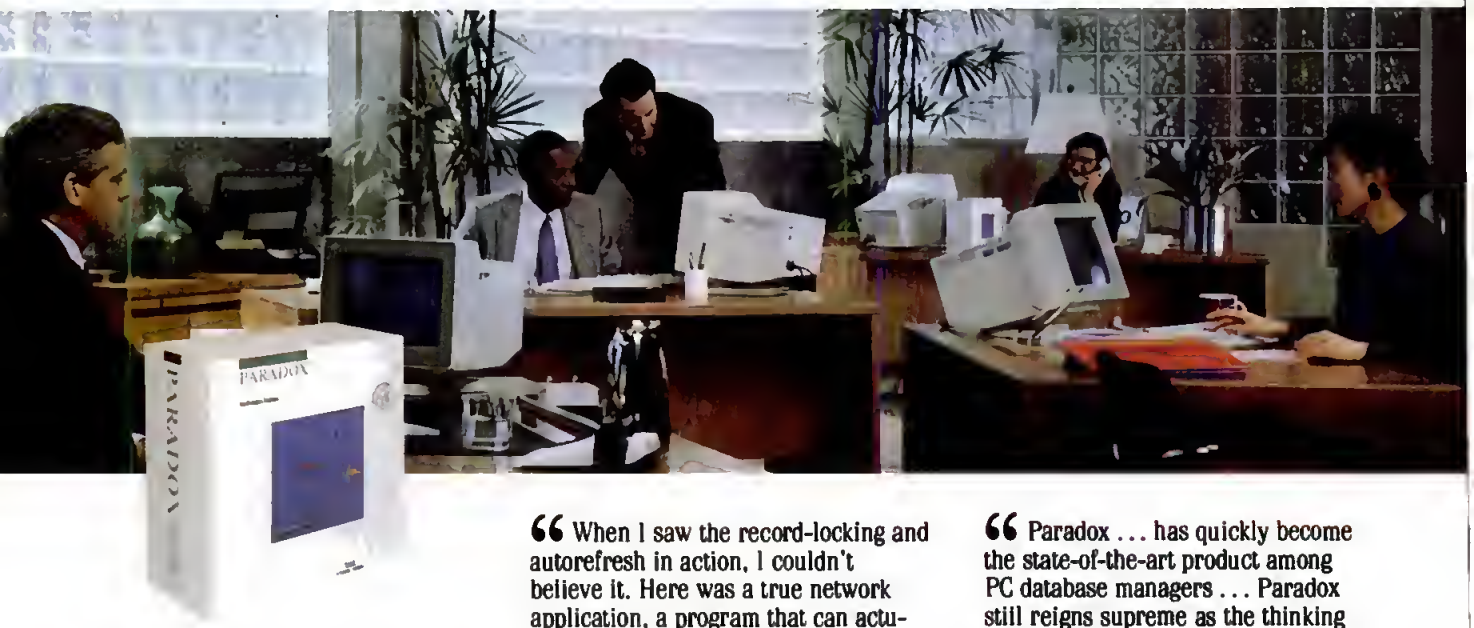
List Price: Mach 20 80286 board, $495; Memory Plus with 512K, $395; Mach 20 with Memory Plus and *Microsoft Excel*, $995; Disk Plus, $99.

Requires: PC, XT, or compatible with one disk drive; DOS 2.0 or later.

In Short: A multifeatured 80286 turbo board, with memory and disk-controller options; the only guaranteed road to OS/2 for PCs and XTs.

CIRCLE 449 ON READER SERVICE CARD

Why Paradox 2.0 makes your network run like clockwork



Paradox® runs smoothly, intelligently and so transparently that multiple users can access the same data at the same time—without being aware of each other or getting in each other's way.

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How to make your multiuser network work

To run Paradox 2.0 or the Paradox Network Pack on a network, you need:

- Novell with Novell Advanced Netware version 2.0A or higher
- 3Com 3Plus with 3Com 3+ operating system version 1.0, 1.1 or higher
- IBM Token Ring or PC Network with IBM PC Local Area Network Program version 1.12 or higher
- Torus Tapestry version 1.45 or higher
- AT&T Starlan version 1.1 or higher
- Banyan VINES version 2.10
- Other network configurations that are 100% compatible with DOS 3.1 and one of the listed networks

System Requirements for the Network Workstation

- DOS 3.1 or higher
- 640K RAM
- Any combination of hard, floppy, or no disk drives
- Compatible monochrome, color, or EGA monitor with adapter

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"When I saw the record-locking and autorefresh in action, I couldn't believe it. Here was a true network application, a program that can actually take advantage of a network to provide more features and functions, things that can't be done with a stand-alone PC.

Aaron Brenner, LAN Magazine

With Version 2.0, Paradox becomes a sophisticated multiuser product that boasts an impressive selection of data-production features and password-security levels.

Rusel DeMaria, PC Week"

Paradox responds instantly to "Query-by-Example"

The method you use to ask questions is called Query-by-Example. Instead of spending time figuring out *how* to do the query, you simply give Paradox an example of the results you're looking for. Paradox picks up the example and automatically seeks the fastest way of getting the answer.

Queries are flexible and interactive. And in Paradox, unlike in other databases, it's just as simple to query more than one table as it is to query one.

"The program elegantly handles all the chores of a multiuser database system with little or no effort by network users.

Mark Cook and Steve King, Data Based Advisor"

"Paradox ... has quickly become the state-of-the-art product among PC database managers ... Paradox still reigns supreme as the thinking user's DBMS.

Jim Seymour, PC Magazine"

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Even if you're a beginner, Paradox is the only relational database manager that you can take out of the box and begin using right away.

Because Paradox is driven by the very latest in artificial intelligence technology, it does almost everything for you—except take itself out of the box. (If you've ever used 1-2-3® or dBASE,® you already know how to use Paradox. It has Lotus-like menus, and Paradox documentation includes "A Quick Guide to Paradox for Lotus Users" and "A Quick Guide to Paradox for dBASE users.") Paradox, it makes your network work.

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Pageview Brings Full WYSIWYG Page Preview to Microsoft Word Documents

PC HANDS ON

BY EDWARD MENDELSON

Microsoft's $49.95 *Microsoft Pageview* lets you control the page layout of *Microsoft Word* files without having to print them first. Until now, you couldn't learn exactly what a *Word* document looked like until you saw it on paper. *Pageview* previews the file screen and lets you alter margins and page breaks. If you run *Pogeview* under *Microsoft Windows* 2.0 or *Windows/386*, you can insert graphics into *Word* files.

By itself, *Word* can't display the location of headers, footnotes, or columns. *Pageview* displays all these and more. When you open a *Word* file in *Pageview*, you see a series of two-page spreads with "greeked" text that gives you a good idea of how type will appear. A zoom command gives you a full-size view of a page with readable text.

You can relocate headers and footers, add page breaks, adjust margins, and insert page numbers, but you can't make any text changes. If you spot a typo, you have to fix it in *Word*. Don't jump between *Pogeview* and *Word* if you run both under *Windows*. Microsoft warns that you'll crash your system unless you close the file in one program before opening it in the other.

Pogeview comes with a limited version of *Windows* that only lets you run *Pogeview* and won't let you import graphics. But if you have the full version of *Windows*, you can use the clipboard to import an image from any other *Windows* program and change its shape and size in your *Word* file. You have to adjust the proportions of the image to avoid squashing or stretching. And because proportions on-screen don't match proportions on paper, a trial printout may come in handy.

After you adjust a file in *Pogeview* you can print it from *Word*. But imported graphics will print only if you print from *Pageview*, using *Windows*' slow printing services.

In an ideal world, *Pageview* would be an integral part of *Word*. In an imperfect world, it's an indispensable addition to a powerful word processor.

PC MAGAZINE FACT FILE

Microsoft Pogeview
Microsoft Corp.
16011 NE 36th Way
P.O. Box 97017
Redmond, WA 98073-97017
(206) 882-8080
List Price: $49.95
Requires: 512K RAM; two disk drives; graphics card; *Microsoft Word*, Version 3.0 or later; DOS 3.0 or later.
In Short: Full WYSIWYG page-preview and graphics manipulation for *Word* documents. Not copy protected.

CIRCLE 433 ON READER SERVICE CARD

$70 Program Simplifies Expense Tracking

PC HANDS ON

BY JENNIFER ZAINO

Spreadsheet programs can be adequate for calculating your business expenses, but expense software like Danart Corp.'s *Expense Moster* makes the job easier by offering predefined, customizable expense forms.

Expense Master helps you track expenses for different clients and job numbers, keep a running total of your account balance, and print year-to-date reports. You can even export *Expense Moster* files, in ASCII text format, to spreadsheet and database programs (although not with all fields intact).

A quick tutorial gets you acquainted with the program. The manual, however, is poorly constructed; for example, the section on customization follows the chapter on printing. Thankfully, the program is so easy to use that you won't have to rely much on the manual.

You enter data into separate entry forms, which are later linked together to form one report. Some items in the entry form, such as report period, department, and expense category, offer access to selection windows at the touch of a character key. The window for each category lists its available choices; for instance, you might choose to report your expenses on a weekly, monthly, or bimonthly basis from the report period selection window.

A menu of other commands, to save and retrieve entry forms or reports, print out reports, or customize the program, pops up when you hit the Slash key.

Choosing a customize command opens a setup window that lets you type in your changes. For instance, you can choose the client category from the business units list and key in your own client names and code numbers. You can just as easily add 40 expense categories to the 60 that are included, or override the report form's summary column headers with your own.



Expense Master *offers flexibility in form categories and the way they're organized.*

Before printing a report, you view the summary on-screen. The summary shows the categories and subtotals of expenses and the dates they were incurred. Account balances, reimbursable amounts, credit card billing, and amounts due to the employee and company can also be viewed. The printed report has all of this, plus the expense descriptions you entered on the entry forms and a rundown of auto expenses.

PC MAGAZINE FACT FILE

Expense Master
Danart Corp.
P.O. Box 267
San Rafael, CA 94915
(415) 454-4200
List Price: $69.95
Requires: 512K RAM, two 5¼-inch drives or one 3½-inch drive, DOS 2.0 or later.
In Short: An easy-to-use program for tracking business expenses. Not copy protected.

CIRCLE 435 ON READER SERVICE CARD

"Those who are considering purchasing 1-2-3 will be better off with Quattro"

—John Walkenbach, InfoWorld



Here's what InfoWorld had to say about Quattro



"There are some clear advantages in choosing Quattro over the 1-2-3 of today: easier installation, no copy protection, improved speed, much better macros, excellent graphics, a customizable command interface, and direct compatibility with industry standard file formats. If cost is a factor, you can get five copies of Quattro for the same money that would buy two 1-2-3 packages."

Quattro includes SQZ!® Plus data compression

A special implementation of SQZ! Plus, the spreadsheet file compression utility, is built into Quattro and comes to you absolutely free. SQZ! Plus for Quattro automatically compacts and expands Quattro spreadsheets by up to 95% during file saving and retrieving.

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Features: Improving the industry standard

"Quattro takes the industry standard and improves upon it in the areas that count most. It addresses many of the weaknesses of 1-2-3 and adds quite a few of its own unique touches."

"Perhaps Quattro's main advantage over most other spreadsheets is its minimal recalculation capability. When you make a change in your spreadsheet, only affected cells are recalculated, greatly speeding things up in most cases."

"Other Quattro features that improve upon the 1-2-3 standard include auto-record macros, vastly superior graphics, and easy installation."

BORLAND INTERNATIONAL

Performance: Markedly superior to 1-2-3

"Our benchmark tests show Quattro markedly superior to 1-2-3 in file saves and retrieves."

"Quattro's graphics are a sight to behold."

"Quattro makes working with macros practically painless. If you're into complex 1-2-3 macros, the debugging feature alone is good reason to make the switch to Quattro."

"No one can argue that Quattro is anything less than an excellent spreadsheet value."

Excerpts from John Walkenbach's review of Quattro™ in InfoWorld, January 11, 1988.

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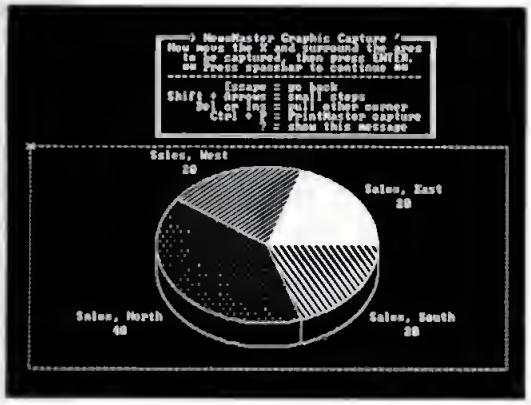
CIRCLE 111 ON READER SERVICE CARD

PC UPDATE

by Paula Seefeldt

NewsMaster II Gains Capture Utility

Unison World has enhanced *NewsMaster II*, its low-end desktop publishing package, with smoothed printing and a capture utility that allows screen graphics to be imported from a range of programs, including *Lotus 1-2-3*. Page layout is more flexible with the addition of tab keys and variable margin and gutter settings. The new version retails for $79.95, with upgrades costing $20 for users who purchased *NewsMaster* before January 1. Unison World, Berkeley, Calif.; (415) 848-6670.



NewsMaster II has a capture utility that imports graphics.

VP-Planner Adds Undo/Redo Capability

Paperback Software has added background priority recalculation and an Undo/Redo capability to Version 2.0 of *VP-Planner*. Worksheets can now be recalculated between keystrokes, and commands may be canceled or reinstated. Additional new features include a File Import Parse command to carry data from fixed ASCII files into a worksheet and a Worksheet Autokey Transcript that records keystrokes. Upgrades are available to registered users for $30 and are free to users who purchased after April 1. Paperback Software International, Berkeley, Calif.; (415) 644-2116.

Deja Links 1-2-3 to dBASE

Deja, Version 3.0, improves the original *Lotus 1-2-3*-to-*dBASE* file transfer program by enabling access to *dBASE* index files and creation of new files. Command execution speed is increased with both faster search and file transfer. The cost to upgrade is $35 for registered users, and the new retail price is $129.95. PC Publishing Inc., Los Angeles, Calif.; (800) 634-4555.

Samna Plus IV Gives On-screen Viewing

Samna has upgraded its *Samna Word IV* and *Samna Plus IV* word processors to Version 2.0. Both programs offer a preview feature that allows on-screen viewing of a document as it will appear in print. A 40,000-entry thesaurus is also new to both word processors. *Plus IV* includes a spreadsheet and a text retrieval function. Upgrades are $35 for users who purchased either package before October 1, 1987. Retail price is $595 for *Samna Word IV* and $695 for *Samna Plus IV*. Samna Corp., Atlanta, Ga.; (404) 851-0007.

Cadam Runs NetBIOS, Ethernet

Cadam has enhanced its PC-based CAD system with *Micro Cadam Cornerstone*, Release 1.3. The updated version adds NetBIOS and Ethernet compatibility to allow multiuser access. A new data exchange utility allows designs to be converted to the .DXF file format. Release 1.3 has a suggested retail price of $2,995 in the U.S. and $3,450 in Europe. Cadam Inc., Burbank, Calif.; (818) 841-9470.

T1200F: More Memory in a Portable

Toshiba has expanded its battery-powered portable computer line with the new **T1200F**. This dual-floppy-disk version has the ability to designate a 384K battery-backed RAMdisk above 640K. A resume mode allows the user to reenter an application after the machine has been turned off. The T1200F retails for $2,399. Toshiba America Inc., Information Systems Division, Irvine, Calif.; (714) 583-3000.



Toshiba's new dual floppy portable, the T1200F, weighs less than 10 pounds.

PS/2 WATCH

SY-TOS Backs Up OS/2

Sytron's *SY-TOS Tape Operating System* becomes the first tape backup system software available under OS/2 with the release of its Version 1.0. *SY-TOS* runs on Compaq PCs and retails for $179.95. Sytron Corp., Marlboro, Mass.; (617) 460-0106 . . . Conetic Systems has entered OS/2 applications with Version 2.25 of its *Higgins* office automation software for workgroups. Upgrades retail for $25 and new packages are priced at $995. Conetic Systems Inc., San Leandro, Calif., (415) 430-8875.

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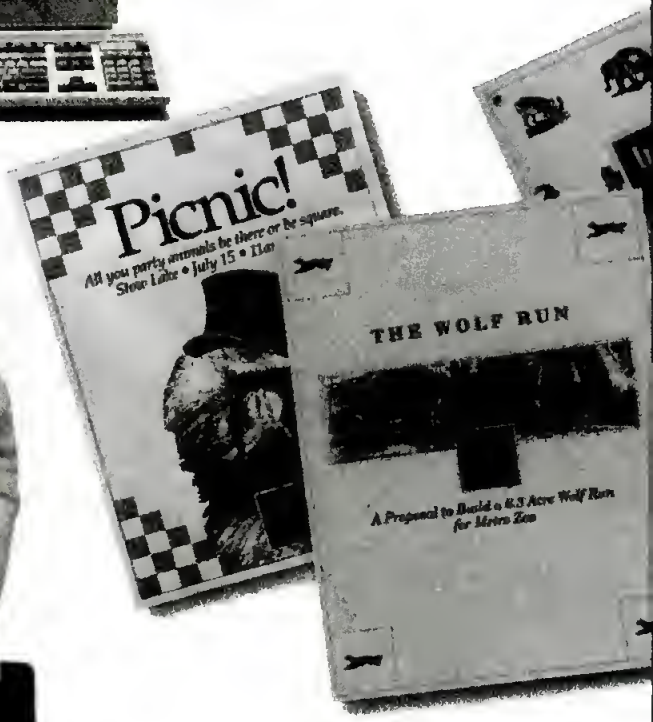


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COMMUNIQUÉS

edited by Bill Howard

Amazing Facts I

"The 286 is not a platform you can build on because its 16-bit technology cannot support the Micro Channel."

—ComputerWorld Focus, *February 3, 1988*

Amazing Facts II

"It's not necessary to connect VGA cards to analog monitors, according to Amnon Rosen, Relisys's product marketing manager, but it's foolhardy to use a basic monitor with an advanced video card because those monitors won't exploit the full capabilities of the card. 'It's like buying a two-story ladder to stand on the first rung,' he said."

—PC Week, *March 8, 1988*

Maybe 6,000 Of William F. Buckley's Words

"Many home computers use floppy disks storing 360,000 characters, about 6,000 English words."

—*Associated Press computer column*, Peoria Journal Star, *February 29, 1988. (The average word is 5 to 6 characters.)*

Those Big Firms Are All Alike

"Microsoft, for its part, has a new Word, a new version of its Wordperfect will be coming later this month, and an improved version of its Wordstar is expected in April or May."

—*Stock market analysis*, Toronto Globe and Mail, *March 14, 1988*

Software features:

ITEM	SURPASS	LOTUS 1-2-3	QUATTRO	EXCEL
Graphics — 3-D Effects	✓	NO	✓	✓
Grahics — Presentation Quality	✓	NO	NO	✓
Graphics — Integrated Printing	✓	NO	✓	✓
Graphics — On-Screen Fonts	✓	NO	✓	✓
Graphics — Full Customization	✓	NO	✓	✓
CGA Support	✓	✓	✓	NO
Ability to Create WKS, WK1 Files	✓	NO	NO	NO
Visual Manager	✓	NO	NO	NO
Price	$495			

That's news to Lotus Development Corp.: according to an advertisement for Surpass, Lotus 1-2-3 *can't create Lotus's own .WKS/.WK1 files.*

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Temporary Part-Time position, must have college degree, be able to handle FAS ANOVA through straight line and quadratic regression, be completely friendly with AT&T 6300 Plus, MS-DOSS, Unix, Crystal, Sigma-plot and so forth. Also be willing to plant, dig, weed, and water horticultural crops. EOE. xxx-xxxx.

—*Help wanted ad*, Plano *(Tex.)* Star Courier, *March 26, 1988*

New Math

"Quad386XT breaks the 640K barrier forever! Your system can address over 4 Gigabytes, or 4,096 Mb of memory. That's over 64,000 megabytes!"

—*Quadram advertising brochure*

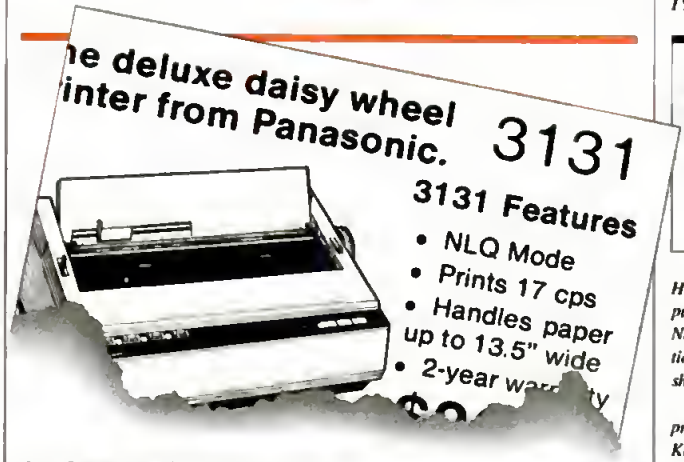
New Accounting

"Timeslips III—$199.95. There's an easy way to keep cash falling through the cracks. Capacity: 3400 clients."

—*North Edge Software ad*, PC World, *February 1988*



News item.
Philippe Kahn opens Greek subsidiary, Boronos Software. (Reading *(Pa.)* Times, *December 9, 1987.)*



Lyco Computer Marketing claims "near letter quality" for this printer—a daisy wheel. (Computer Shopper, *March 1988.*)

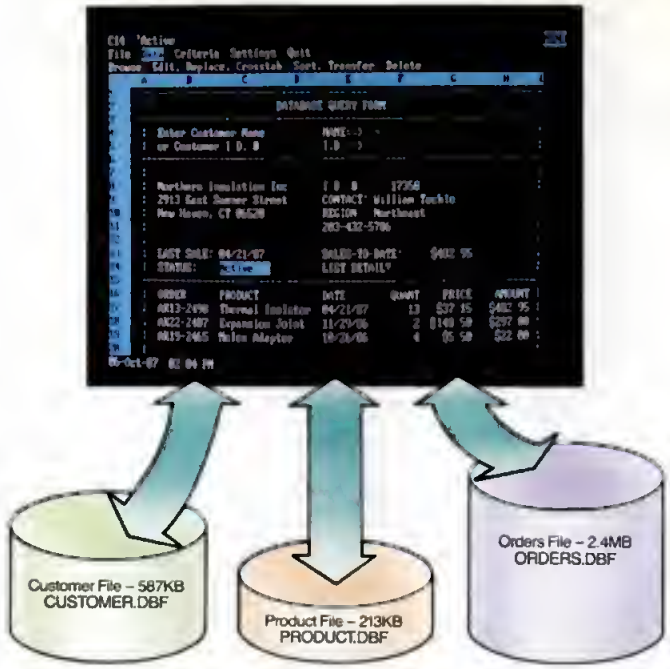
So Never Look Directly into the Data Cable if It Comes Unplugged

"Laser printers work by transmitting an image of the information on your computer to a piece of paper via laser beam."

—Entrepreneur *magazine, February 1988*

Have you heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send submissions to Communiqués, PC Magazine, *One Park Avenue, New York, NY 10016. Print your name legibly and include the name, city, and publication date of any newspaper clipping. Contributors receive $50 and a* PC Magazine *T-shirt (include your shirt size).*

Winners this issue: Mike Stott (Boronos Sofware), C.T. Bradley (Panasonic NLQ printer), Carol Newbill (Surpass advertisement), Neil Gould (part-time position), Khaled Rafih (Microsoft WordPerfect*), Phillip G. Pflueger (Quad386XT), Brian W. Harriger (laser printers), Mark Coker (Timeslips III), Gary Hansen (286 platform), David Bufford (VGA cards).*



dBASE Power for 1-2-3

Last year we met a crazy programmer who said he could build a database with the power and capacity of dBASE and put it *inside 1-2-3*. Well, he works for us now, and if you know anything about database programs, his baby is going to knock your socks off.

Introducing @ BASE, a full-feature relational database add-in for 1-2-3. Now anyone who knows how to use 1-2-3 is an instant database wizard because @ BASE turns 1-2-3 into a powerful "front-end" for database applications. *It's as easy as 1-2-3.*

Huge capacity

If you've every tried to use 1-2-3 as a database manager, there's a good chance you've run out of memory. That's because 1-2-3 stores data in the worksheet. @ BASE stores data on disk where record capacity is virtually unlimited. You'll never run out of memory again.

Brains and brawn

@ BASE compares with powerful stand-alone database programs like dBASE or R:BASE,® but it operates in concert with 1-2-3. You get the best of both worlds. 1-2-3 gives you tools for data analysis. @ BASE gives you big data capacity. Brains and brawn. It's a nice combination.

In minutes you can build a worksheet with dynamic links to the database on disk. (The worksheet might present a sales recap by region.) Next month, for up-to-date results, simply load and recalc the worksheet. Fresh database information is automatically linked from disk.

See our ad on page 353

Industry-standard file format

@ BASE uses exactly the same file format as dBASE III and dBASE III Plus. *dBASE is not required to use @ BASE.* But if you have standardized on dBASE, @ BASE fits right in. @ BASE reads and writes dBASE files directly. No conversion is necessary.

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@ BASE beats dBASE III Plus in benchmark tests.* @ BASE is up to 3.7 times faster!

	dBASE III Plus	@ BASE
Locate record	12 sec	12 sec
Pack database	7.1 min	1.9 min
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*Test with 4,000 records, 34 fields per record

@ BASE works with 1-2-3 Release 2 on the IBM PC, XT, AT, PS/2 and compatibles. Only $195. No competing add-in database can match @ BASE for power, compatibility and performance. *Nothing even comes close.*

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FoxBASE+/Mac's BROWSE feature brings new convenience and power to database display and editing! You're in complete control—BROWSE lets you dynamically adjust the size and order of fields displayed, add or delete records, and split the window to show different database sections side-by-side. Together, BROWSE and View Windows *eliminate* the need to write programs for common database operations!

Integrated Graphics.

Copy and paste graphs, charts, diagrams and even pictures into your database—instantly! FoxBASE+/Mac gives you the power to display these graphics, or merge them into reports and documents!



You can create stunning screens like this with FoxBASE+/Mac—*immediately!* This actual FoxBASE+/Mac screen photo illustrates the View Window, Command Window, Integrated Graphics, Memo field editing, Trace and Debugging Facilities, and the BROWSE feature.

Command Window.

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CIRCLE 112 ON READER SERVICE CARD

■ BILL MACHRONE

BUILDING BETTER MEMORIES



Flash EEPROM could provide the key to the PCs of the future: fast, secure machines with bigger memory-storage capacity—and no moving mechanical parts.

It's kind of primitive when you think about it.

There, in the heart of your computer, amid all those electronic highways and byways, with bytes flying by at nanosecond speeds in blinding silence and programs executing with cool, logical, silicon precision, lurks a flailing, whirling, mechanical throwback to the dark ages of computerdom: your hard disk.

It's kind of improbable, too. Megabytes of data stream by under a head that looks like a tiny trimaran, windsurfing just millionths of an inch above a magnetic disk. A metal arm whips the head back and forth over the disk, seeking data, scanning a firestream of bits for a unique code that will identify the succeeding bits as the sector your program is looking for.

Is this any way to store your data? Some people don't think so. Random-access memory has always been a tempting alternative to the flailing disk. It's far faster, and it has no mechanical frailties.

The obstacles have been daunting. Memory chips have this nasty habit of forgetting what's been written to them when you shut off the machine. Dynamic RAM, the kind that's in your PC, is so forgetful it needs to be reminded every thousandth of a second or so. Static RAM is less forgetful, needing only power to keep its data alive.

Static RAM, however, needs six transistors to store each bit of data, while dynamic RAM needs only two. Thus, dynamic RAM chips can be far smaller than statics. But even if static RAM could be as small as dynamic RAM, you would be justified in not entrusting your data to it. What if someone trips over the line cord? What if the battery goes dead?

FAMILY TREE So the dream of a computer with no moving parts lies beyond reach. Or does it? A new chip technology, flash EEPROM, could set the mass storage world on its ear. Flash EEPROM is far up the evolutionary ladder from ordinary RAM. A quick trip through the family tree will put things in perspective.

ROMs (read-only memories) are close cousins to RAMs, except that they don't forget what you tell them, even with the power removed. ROMs can be programmed once and read as often as necessary. Your system's BIOS is stored on ROM or PROM. There is a subtle distinction between the two. ROMs are usually programmed in one of the last steps during manufacture. PROMs are programmed electrically *after* manufacture. Neither can be altered once programmed.



EPROMs (erasable programmable read-only memories) have a distinctive glass window on top of the chip. The chip can be programmed electrically. When you reprogram an EPROM, you put it in a chip-sized tanning salon that delivers a strong dose of ultraviolet light, which erases the chip's data. Without ultraviolet light, the chip will hold data for 10 years or more. EPROMs are limited in the number of times they can be reprogrammed. They become unreliable around 100 cycles.

EEPROMs (electrically erasable programmable read-only memories) are like EPROMs, except they can be erased electrically while on the circuit board. They too become unreliable after a number of programming and erasure cycles.

Enter flash EEPROM. The "flash" refers to the way the chip is erased. A single control signal causes the chip to forget everything it knows. It can then be quickly reprogrammed.

Flash EEPROM is interesting for two reasons. First, its engineers are reasonably confident that they can develop flash chips that can be erased and reprogrammed enough times to make them viable competitors to hard disk drives. Second, EEPROMs use only one transistor per memory bit. Flash EEPROMs are therefore potentially twice as dense as RAM—which, as you know, is headed toward 4-megabit and even 16-megabit chips.

The majority of the information on your hard disk never changes. If you were updating *Lotus 1-2-3*, for instance, the system files would change only once every

Illustration: Darryl Ligasan

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CIRCLE 179 ON READER SERVICE CARD

■ **BILL MACHRONE**

couple of years. A small percentage of your files change rapidly: documents under revision, temporary files, and print spooler files. It would not be difficult to engineer memory systems optimized to the way personal computers are actually used.

DISKLESS WORKSTATIONS Today's diskless workstations will come to be seen as premature, or even off the mark, although well intentioned. They are effective in high-speed LAN environments, but questionable elsewhere. Diskless workstations do make sense in high-security computing environments; the floppy disk is the real vehicle of most data theft.

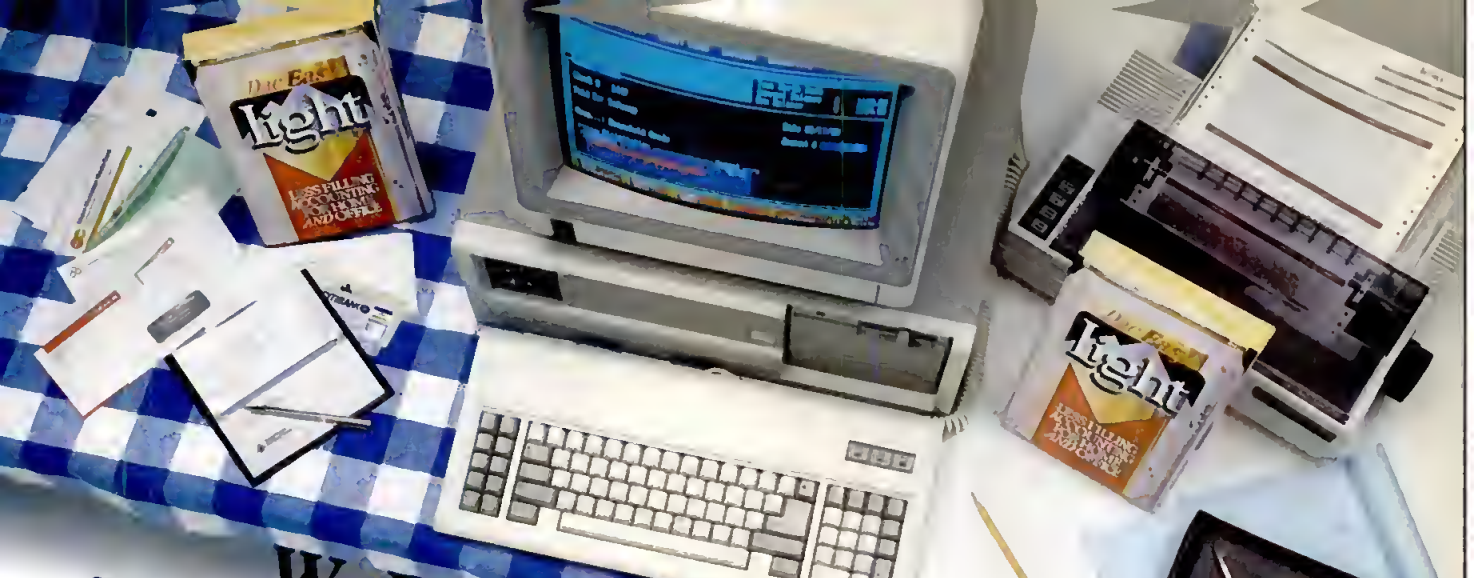
Local nonvolatile memory can store all the executable programs you need, plus a significant portion of the data you use regularly. Local storage means cheaper networking. If the network doesn't have to emulate hard-disk performance, it can be slower and use less-expensive wiring and adapter boards. As we head toward true distributed processing, system software will be able to manage data stored locally and in the host. DataEase's micro-to-mainframe software can do this already. Can networks be far behind?

BLOCK OF SILICON A PC with no moving parts need never be turned off. If the memory system is dual-ported, it can be updated from remote hosts at any time; thus the user will always be working with the most current data. Also, the contents of EEPROM can be encrypted so that it is unreadable except with a code issued by the host, the user, or both.

The nonvolatility of EEPROM raises some other interesting possibilities. Is there any reason why it can't replace floppy disks? I can't think of one. With surface mount and wafer-scale technologies, EEPROM modules may match 3½-inch floppies in size and storage density.

Is flash EEPROM a guaranteed winner? For the moment, its success appears inevitable. Many obstacles, however, stand in the way. Continuing developments in the competing hard-disk technology will raise storage density and reliability while prices remain constant or even fall.

I vote for flash EEPROM. The temptation of the block-of-silicon PC is just too attractive. PC



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CIRCLE 134 ON READER SERVICE CARD

■ JOHN C. DVORAK

THE SOFTWARE ENTROPY EFFECT



It's time to start recognizing our most talented programmers, unless we want to end up having all of the great programs ruined by committee.

It's a lost cause. The best software writers write one or, at most, two hit programs and then disappear from the scene. They usually burn out, become fascinated by the concept of an "opposite" sex, or simply turn strange. The upgrades and new projects that come after the superstars quit usually turn sour and grow fat, ugly, and inefficient. Meanwhile, the original programmer is in Bimini swearing off coding.

I call this the Software Entropy Effect. Entropy, simply defined, is the steady degradation or decay of any system. Laws of physics predict that any system will experience entropy after time.

Software entropy is a different sort of animal because it seems preventable. That is if we understand its nature.

PROGRAMMER BURNOUT The problem with programmers appears to be simple burnout. The great ones like Jonathan Sachs (who wrote *Lotus 1-2-3*) just may not have another killer program in them, they say. Meanwhile, it's taking a horde of coders an inordinate length of time to write *1-2-3*, Release 3.0. When it is finally released it may take a box of floppy disks or a mag tape to load it. The same holds true for *dBASE IV* and other once-elegant programs.

The only company that bucks this trend is the supersuccessful Microsoft. It starts off with a product designed by committee and later has efficiency experts come in and clean it up. This is not a process that someone looking for an out-of-the-box runaway hit product can get away with.

Meanwhile, we still see one software great after another bite the dust after they put their heart and soul into the product. They sometimes get famous and decide that coding is for geeks. Now they want to design products and supervise geeks. It never works. It's like supervising someone writing a great work of literature. It turns out to be easier to do it yourself than to supervise someone with less talent.

There's an old joke about how one programmer can get a product finished in a year. The same project would take two programmers, working together, a year and a half. Three guys would take 2 years. And so on.

This still begs the question about what to do about burnout. We can't afford to have our best programmers simply cash out each time one hits the big time. Did Lennon and McCartney quit writing songs and recording hits once they made a million bucks? No, and they were no less the nerd than any computer programmer. Let's face it, rock stars are nerds like no other. Asocial, dopey, practicing all the time, clumsy, immature. Worse than the worst programmer. But why do rockers continue their careers while programmers quit?



As I pondered this I realized that one group of programmers—the game designers—seem to churn out hit after hit. All this while the business, or "practical," software programmer burns out. What's the similarity between the game programmer and the rock nerd that's different from the Rob Barnabys (who wrote *WordStar* 1.0) of the world? Recognition, that's what. The best game programmers are like popular novelists—their names come first. Chris Crawford is an example of a game designer who we all know. Ask yourself who wrote *Microsoft Word* 3.0? Not Bill Gates, but some anonymous souls who will sicken of the job. Gates, meanwhile, gets the credit.

Personally, I don't care if guys get credit for what they do. I just use the stuff. Same with music. I just listen. I want to know the name of the group only if I want to buy the album. Even then I usually can't remember and have to hum the tune to the store clerk. But to artists, credit is everything. Steve Jobs knew this when he had the names of the creators of the original Macintosh inscribed permanently inside the case of the thing.

Money pays bills. Accolades drive the creative to greater heights. Let's start a program to credit the great programmers for their achievements. And, above all, let's put their names on the box.

Illustration: Darryl Lagasan



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CIRCLE 245 ON READER SERVICE CARD

■ JOHN C. DVORAK

INSIDE TRACK

On your mark . . . get set . . . go! 80486 mania to commence before the end of the year.

Already there is much talk on the street about the **Intel 80486.** Take all those old clippings about the 80386 and rewrite them to apply to the 80486: it's the chip of choice, no reason to buy anything else, etc., etc. We are starting to hear déjà vu rumblings that the 80386 is an interim chip—a prelude to this upcoming screamer. Before Intel begins shipping the 25-MHz 386, we are told that the 486 will start at 25 MHz and quickly be sold at **30 MHz and faster.** Looks like the same pattern we've seen before.

A few **curiosities** about the 80486 chip: 8080 code will be executable on the thing (zounds!); 8086 code will be executable and so will 80286 code. A couple of obscure 80386 modes will not be supported.

The 80486 is supposed to cut the cycle time on a few complex 80386 instructions to one or two cycles of the clock as opposed to the six or eight cycles needed before. Combined with the faster clock speed this chip may easily achieve 8 to 10 million instructions per second and it's aimed right at the newer reduced instruction set chips (RISC) that are coming into the market. Intel supposedly uses some fancy RISC-like structures but is not calling this chip RISC in any way.

We are also told that the chip will incorporate into its main design much of the **floating-point arithmetic** usually sent off to a coprocessor. Furthermore, the chip is designed as a **CMOS** chip and will use very little power. Insiders expect samples to be available by the end of the year. The way things are going, I expect we will have a Cray X/MP on our desks by the mid-1990s.

My take on all this. Looking at the power of the 80486 combined with IBM's licensing of the Micro Channel, I'd say that the 80486 will be the first chip to show up exclusively on the Micro Channel and will probably hail the next generation of machine. The 80386 will be the last chip to use the old PC bus. **Get ready to sell everything you own (again) so that you can afford the upgrade.** Will this ever end??

While on the Subject of Mips Dept.: Ever wonder how people are determining the mips (million instructions per second) of the hot machines out there? They are all using what is probably the **finest benchmark software** available for micros: ***Power Meter,*** from The Database Group (3031 Tisch Way, # 2 Plaza West, San Jose, CA 95128; (408) 241-2981). This $89.95 gem of a product has dozens and dozens of tests that you can put your machine through. Everything from testing the speed of a spreadsheet recalc to the character write speed of the video card. It's pretty amazing. One test determines normalized mips based on VAX mips. The best part is that the program maintains a database of all your tests so that when you test a machine, you have all the other machines in the database with which to compare it. If you find that you haven't seen this product mentioned much, it's because it's the one that everyone wants to keep **a secret** so they can quietly use it themselves. No kidding. Great product.

Genuinely Interesting Software Dept.: Here's a new category of software: **the event processor.** The package is called *Auto-Might,* and it's from the Pendulum Group (333 W. Hampton Ave., # 1015, Englewood, CO 80110; (303) 781-0575). What this $49.95 program does is sit in memory and wait for the real-time clock to **trigger a program execution.** This is perfect as a way to run a series of time-consuming tasks at 3 o'clock in the morning when nobody is around. The program can even feed keystrokes to another program. As with all memory-resident programs, you must test it for compatibility with other TSR programs.

Souping Up That Old Clunker Dept.: This will be the year that a lot of you decide to keep your old PC or XT, and instead of buying a 386 screamer, you'll just add the new Microsoft Mach 20 card, a SOTA board, a Micro 286, a Quad 386, or any number of the excellent 286/386 add-in bus cards on the market. These will **increase performance** by **300 percent** or more. Then you'll look to find that the old clunker has only a 10MB hard disk. What's the cheapest way to upgrade the old hard disk? Take a look at ***Newspace*** from Isogon Corp. (330 7th Ave., New York, NY 10001; (212) 967-2424).

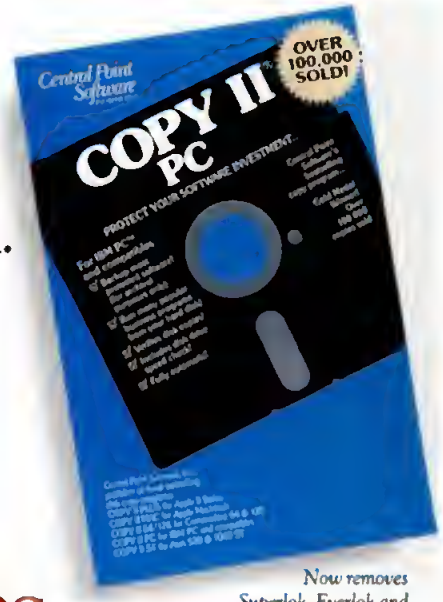
Using an elaborate data-compression scheme, *Newspace* will nearly double the capacity of your hard disk. And it's even smart enough to decompress the files when copying to floppy disks or when sending on a modem. It also has a built-in unerase facility. While there are a few gotchas in this program such as the fact that it won't work in a multitasking environment (but who with an old PC cares?), this is one **nifty** package for $69.95. I've seen hardware that sells for $300 or more that doesn't do any more than this software solution.

Bargain of the Month. Here's a company with a terrific and inexpensive 2,400-bits-per-second modem. It sells mainly into the Atari market, so you may not have heard of **Supra Corp.** (1133 Commercial Way, Albany, OR 97321; (503) 967-9075). The list price for the **2,400-bps Hayes-compatible modem is a mere $179.95.** It's a dynamite little modem. Now there is **no excuse** not to go to 2,400 bps. PC

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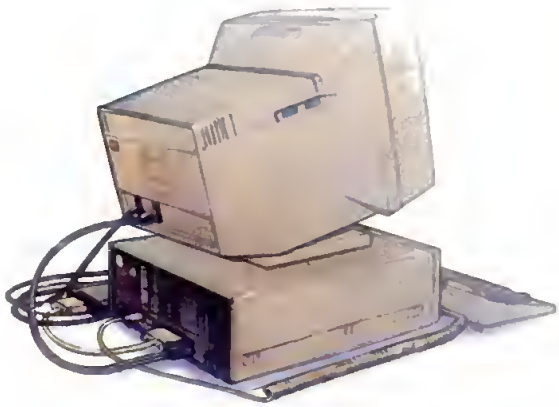
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■ JIM SEYMOUR

SOFTWARE DELAYS: TRUTH OR CONSEQUENCES



It's almost become standard practice for companies to release software much later than the originally announced delivery dates. The problem's getting worse, but who's to blame?

Has the software development process for new application programs gotten out of hand? Have the size and complexity of new-generation PC programs outgrown the glorified garage-shop development process still widely used in the PC software business?

Lotus's fumble in bringing *1-2-3*, Release 3.0, to market has started a lot of large-scale software buyers asking these sorts of questions. The company announced in late March that the release would be held up at least 6 months, from an announced delivery sometime late in the second quarter to near the end of the fourth quarter. The delay was hugely embarrassing for Lotus.

(It didn't help that several executives had sold major Lotus holdings shortly before the announcement, nor that when pressed those executives said they had no knowledge of the pending delay at the time they sold their stock. This despite the fact that Chuck Digate—the man heading the division responsible for bringing *1-2-3*, Release 3, to market—left the company 2 weeks before the announced delay. I believe the Lotus people when they say they weren't bailing out in advance of the inevitable drop in Lotus's stock price when the delay was announced—they're honorable men—but many find the coincidence fishy at best.)

For Lotus, the real price of the delay isn't measured in embarrassment, but in lost opportunity: by delaying *1-2-3*, Release 3—a product already under siege by *Microsoft Excel, Quattro, Surpass*, and others—Lotus gives its competitors a much bigger window of opportunity to establish their products and nibble at its market share. And Lotus is giving its customers something to think about, too: Is the development process out of control when an already overdue product slips by that much?

LATE FOR IMPORTANT DATES The real story here isn't Lotus's delay. The key point is that major, unanticipated delays in delivering new products have become widespread. Ashton-Tate was late with *dBASE IV*. WordPerfect Corp. was late with *WordPerfect* 5.0 and grievously late with *WordPerfect for the Macintosh*. Migent Software was a year late with *Emerald Bay*. Ann Arbor Softworks was also a year late with *FullWrite Professional* for the Mac, and the owners finally had to sell the company to Ashton-Tate to get the product out. Borland International was way late with both *SideKick Plus* and *Sprint*. And Microsoft was *years* late with *Windows*.



Indeed, late delivery of announced software products has become endemic in the PC business. And failures by so many major PC software firms to deliver the goods on time brings into question the competence and truthfulness of those firms' management, the motivation behind their new product announcements and projected delivery dates, and the development process itself.

WHY THE DELAY? Yes, programs have grown a lot bigger and more complex. Yes, changes in PC operating systems and the effort to move programs onto the Macintosh, Unix machines, and other platforms have taken their toll. And yes, the shortage of skilled programmers has contributed to the problem.

But none of those reasons can explain the delays we're seeing. The problem is twofold:

First, there's a marketing imperative. Announcing half-baked software products has come to be seen as a necessary positioning exercise. We've moved into an environment where the de facto preannouncement of products that are far from ready to ship—and the subsequent (and inevitable) failure to deliver those products in a timely way—have become widely tolerated by PC buyers, and widely accepted among vendors as just another competitive weapon.

That means we've begun to institutionalize this kind of flawed process, and that hardly promises early improvements.

Illustration: Darryl Ligasan

■ JIM SEYMOUR

Second, and more ominous, PC software developers haven't done much to improve the way they manage the development process. A 500,000-line program isn't just an order of magnitude larger than a 50,000-line program; it represents a management problem several orders of magnitude more difficult than the development of the smaller program.

And managing the development of several programs, each in several versions for different platforms, makes things tougher still.

Screw-ups in version management, the inadvertent use of old and obsolete pieces of code or the wrong version of a compiler, and other failures in project management have all contributed to the chaos we now see in getting software products out the door on time.

■ Until you and I refuse to take preannounced products any more seriously than their creators do, we're likely to see these delays continue—and lengthen.

THE BAD NEWS IS... Put simply, the transition from a cottage industry to a high-tech industrial process has gone badly in the PC software business. Developing software is as much an art as a science, and it's more of both, programmers like to say, than it is a business. You can't get a program out the door twice as fast by hiring twice as many programmers—even if they were available. If 20 programmers can get a program finished in 6 months, 40 programmers will take a year. And the program will be worse.

The bad news: This isn't going to get any better in the near term, and it will probably get worse. There is no evidence that the majors in this business—Microsoft, Lotus, Ashton-Tate, Borland—have gotten any better at managing large-scale development work.

Until you and I refuse to take preannounced products any more seriously than their creators do, we're likely to see these delays continue—and lengthen.

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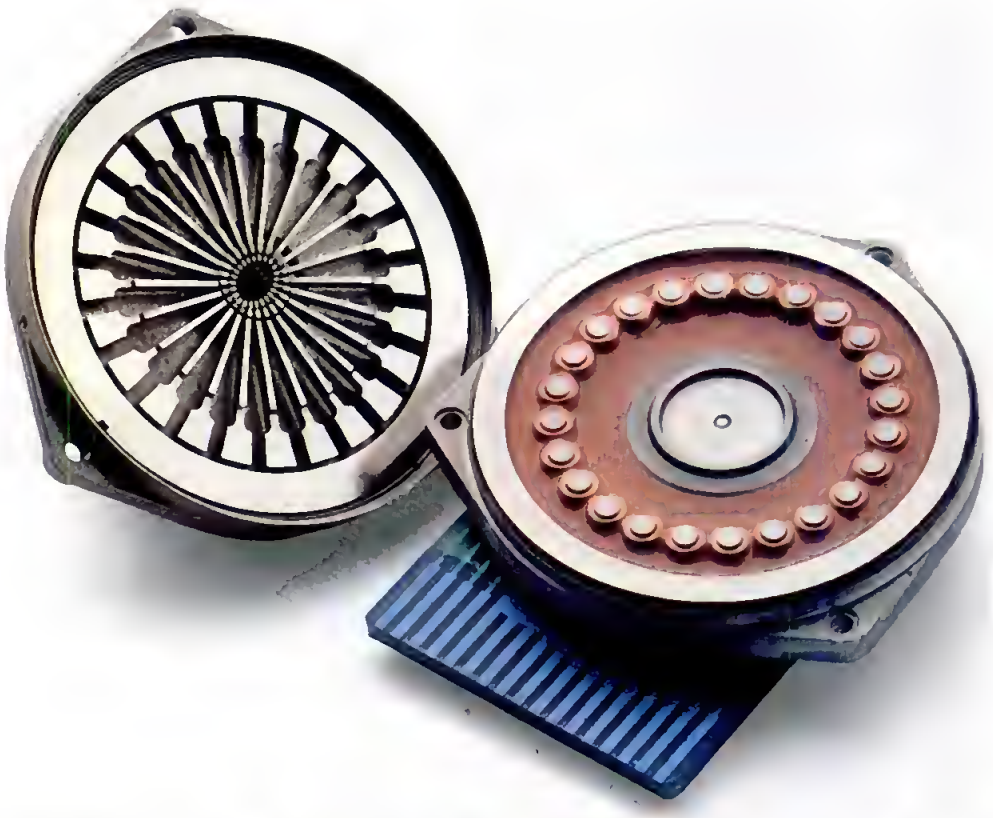
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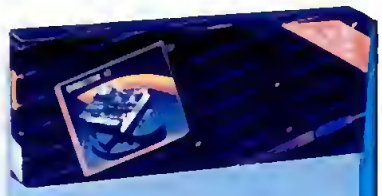
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CLICK THE BUTTON MARKED "INTERACTIVE"



For the first time ever, a columnist uses modern techniques to let you take command! It's another breakthrough in the drive toward interactivity

Ready?

[Yes] [No] [Cancel]

Good! This year's hot buzzword is "interactive." Say it now, please:

ĭn´ter-ăc´tĭv

Very good! Does it remind you of anything?

ENTER YOUR RESPONSE HERE>

Right! It's the exact same word that seemed ubiquitous a few years back in the heyday of the video game! So why has it risen like a caped Alan Alda from the grave of the Unsold Atari Cartridge?

[I Don't Know] [Tell Me More]

Because industry is trying to ram it down our throats again, that's why. Information providers with giant databases and old movies moldering in the vaults see products like the CD-I and their "interactivity" as a new flask for their aging Lambrusco. Computer companies claim "interactive" hypertext is just the thing for navigating through masses of data on CD-ROM. Educators in particular hail "interactive multimedia" as the high-speed interstate to knowledge.

PLEASE HOLLER: "Whoa! Multimedia?"

Sorry. "Multimedia" is another hoary term that's coming up fast in the catchword competition. This one's been filched from the world of education, where the library has become the "media center," and from corporate America, where the "multimedia presentation" is best defined as a dull speech interrupted by a duller slide show. But let an educator tell it:

[Continue] [Cancel]

"Instead of just using text to teach about the Constitution, teachers can enliven class discussion with rich visuals such as paintings of the drafters of the Constitution, maps of colonial America, political cartoons, and a film clip from the play *1776*. Of course, the visual information can be linked to text from the Magna Carta, the Federalist Papers, or current court cases. In short, teachers and students can have a great learning experience exploring the Constitution."

SNICKER AND SAY: "Without ever bothering to read it."

This idea of imparting historical wisdom to impressionable children by means of bad Broadway musicals comes from



Interactive Multimedia, a double-buzzword Microsoft Press volume. Its introduction by Apple Computer chairman John Sculley claims, "The book you are holding is a beacon pointing to an exciting future for American education."

[Nice Turn of Phrase, John] [Oh, Shut Up]

The book, it should be noted, is copyrighted by Apple Computer Inc. Its editors are Apple employees. Its illustrations include lots of ugly overstuffed Macintosh screens and a few even uglier Apple II displays. Its text misses no opportunity to pay repeated homage to the wonders of Apple's HyperCard program.

[Please Go On] [If You Must]

Since Apple has staked out a claim for itself as the educational computer company, its claim that computers, CD-ROMs, and other expensive wares—hard and soft—will be the saviors of America's schools isn't exactly surprising. But those few of us with nonvolatile memories may still recall the dismal failure of such previous technological educational panaceas as "audio-visual aids," "educational television," "programmed learning," "learning labs," and "computerized drill." Such brilliant ideas have managed to produce a whole generation of kids and adults who are incapable of programming their VCRs to record "The PTL Club," let alone reading the shorter articles in *USA Today*. In that light, the idea of jazzing up

Illustration: Darryl Lugosan

■ STEPHEN MANES

instructional materials with multimedia and interactivity seems likely to be little more than just a clever means of transferring dollars from the pockets of the taxpayer to the coffers of Apple Computer, CD-I makers, etc., ad infinitum.

YOUR RESPONSE, PLEASE>

Maybe so. My cynicism is fortified by a quote from one of Apple's educational psychologists: "This is a call for continuing, formative evaluation of our design work, in which we test our assumptions about learners as well as our program content against educational goals. In this way, we ensure that the tools we create will truly enhance the learning process for all learners." When someone who can write such an indigestible doughball of prose is telling us how we should teach our kids, there's something wrong somewhere.

■ How come Apple's paean to interactivity doesn't include that most interactive of printed tools—an index?

Abort, Retry, Fail?

There are plenty of places where interactive media might work well. The example everybody always cites is the "electronic shop manual" showing you step by step how to change your car's muffler grommets or flywheel gasket. But nobody mentions how expensive it may be to produce that "interactive" manual, or why it will magically be better thought out than the miserably written book version you have to use now. And speaking of books, how come Apple's paean to interactivity doesn't include that most interactive of printed tools—an index?

PLEASE INHALE DEEPLY
AND SIGH:
"Whew! Something's funky!"

Let's review: When the CD-ROM Encyclopedia salesperson comes knocking at your door and tells you how much your kids will get out of this latest edition because it's so "interactive," how will you respond?

"My foot is about to interact
with your posterior"
GO ON TO NEXT ARTICLE

"Gee, sounds great"
RETURN TO START

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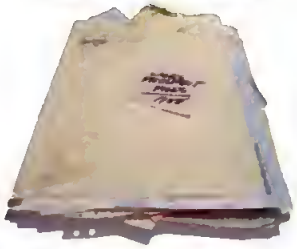
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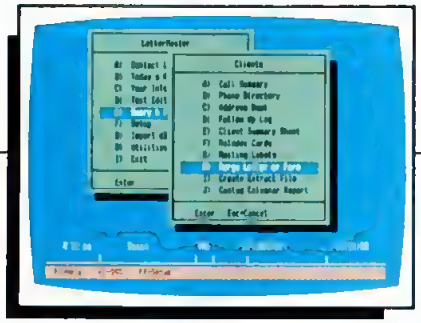
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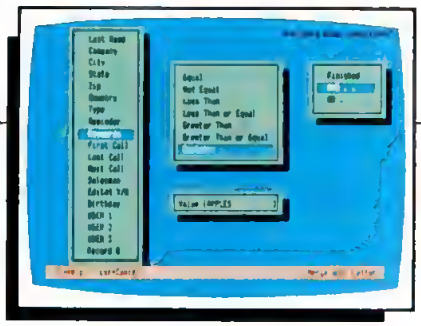


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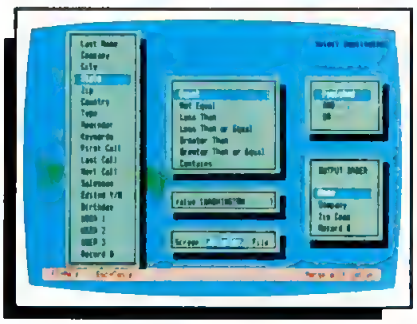


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CIRCLE 393 ON READER SERVICE CARD

20-MHz 386s

HUSTLE WITH MUSCLE

The first wave of 20-MHz 386-based PCs maximizes speed and raw power with innovations that bode well for high-end desktop computing. Take a look at the newest from ALR, American Mitac, Core, HEI, HP, IDR, Logix, Micro 1, Proteus, and VIPC.

Twice as good as a perfect ten—the latest crop of 80386-based computers rate at least that high, even if all you count is their megahertz. These are the fastest, most powerful computers you can put on or by your desk.

It's not just that they are all based on Intel 80386 microprocessors racing along at a 20-MHz clock rate. Because of clever memory-handling methods that cut wait states and boost throughput, most of these machines deliver more than the 25 percent speed increase over 16-MHz machines that their clock frequency would imply.

The story behind these wunderkind computers is more than speed, however. Together they reveal a new twist in the PC industry. Look at the strange acronyms and new names: these are second-string manufacturers—in sales, not in quality or innovation. When many of these and similar companies moved into the AT-compatible field, they sent prices plummeting. With their entrance into the high-speed 80386 arena, we can expect more of the same.

Along with competition, these computer makers are also bringing new ideas into the 80386 market. Not long ago, nearly all compatible computers were slavishly cast from the same mold that someone seemed to have slipped out of the IBM factory in the dead of night. At best, those cookie-

cutter-styled ATs in square metal boxes were spiced up with a bit of plastic styling that served, like the chrome on 1950s automobiles, to make what was essentially the same seem different.

Some of these 20-MHz 386s take the concept and design of the PC into new and wonderful directions. Almost every one has its own distinctive styling that purposely points it in a direction leading away from the beaten path to its own market niche.

No longer can you anticipate what's going to be in the box. The high-performance 80386-based PC may be engineered into a towerlike minicomputer that can replace VAXs and serve an entire business department. Or all those megahertz may be crammed inside a compact box that looks to be more like a stand designed to give your monitor a lift. Many are designed to be the executive's Excalibur, a magic weapon that whittles through words and numbers at unprecedented speed. Others are computers designed primarily as graphics workstations, engineering design centers, or file servers for massive databases.

SPEED ISSUES Twenty-megahertz 386 computers don't work their performance miracles just by tossing in a quicker microprocessor and dumping in wait states to keep the system on an even keel, the way the first 80386-based PCs did. Increasingly they use top-speed cached processing—a technique proven in minicomputers. As the cache and ever-quicker RAM methods become the norm, performance is rising to a point where it's measured in multiples of ordinary AT (or PS/2 Models 50 and 60) power.

Yet none of these 32-bit processing powerhouses ranked as the ultimate personal computer. On the horizon is the next electronic adrenalin injection of high performance for PCs: Intel's introduction of an improved 80386 capable of operating at 25 MHz. Once computer makers are armed with that chip, you can expect them to hype another 25 percent performance boost. Given that the extra 4 MHz that 20-MHz machines add often demands a substantial price premium over base-model 16-MHz 80386-based PCs, this pack of thoroughbreds may look like an expensive set of interim engines, ready to chug off to never-never land as soon as the higher-speed processors arrive.

But the future for these machines is not so bleak. While a faster microprocessor will certainly increase the number-crunching capabilities of a computer, new 80386s will run into the same barricade faced by fast 80286s in most other operations: the aged PC expansion bus just can't keep up. Most expansion cards designed for ATs run out of gas in the 10- to 12-MHz range. In fact, operating many of them becomes chancy whenever you try to tiptoe past the 8-MHz limit officially observed by IBM.

With few exceptions, all higher-performance computers operate their expansion buses in the 8- to 10-MHz range. Most 16-MHz 80386-based PCs, for instance, run their expansion buses at half-speed and impose wait states all over the place when they need to jump on the bus. Moreover, even if faster expansion boards were available, running the bus at full speed would be daunting because the PC bus was never designed to operate that fast. FCC certification of such fast-bus computers would be difficult to achieve. Note that only five of these machines, the models from American Mitac, Core, HP, Micro 1, and Proteus, meet the stringent FCC Class B certification standard.

A fast processor and slow bus mean that any superspeed 80386s that rely on the PC bus will have to contend with the hurry-up-and-wait syndrome. The 20-MHz machines suffer only somewhat from the problem; faster computers will languish even more. Disk I/O, video writing, and 16-bit memory operations will drag down overall throughput so that you won't benefit as much as you may think from a 25 percent clock increase to 25 MHz. One important application for fast hardware—file serving—will be particularly handicapped because the majority of system operations will involve accessing its hard disk through the choked expansion channel.

Just as there's no reason to buy an 80286-based computer anymore (unless you're offered a rock-bottom price) because the 80386 is demonstrably superior, you've no reason to backtrack to 16 MHz except to hunt for a relative bargain. Although 25-MHz-or-faster clocks may eventually prevail, actual throughput of future systems based on the PC bus are unlikely to climb much further. For a real quantum improvement, you'll have to wait for the long-prophesied Micro Channel machines—and you'll probably want to wait until teething pains subside and the new channel proves itself.

Just as there's no reason to buy an 80286-based computer anymore because the 80386 is superior, you've no reason to backtrack to 16 MHz except to hunt for a bargain.

In other words, 20-MHz 80386-based PCs may be the best compromise of compatibility, throughput, and proven reliability that you'll find for quite some time to come. Look past the acronyms, and you're likely to find a top-performing PC to race through all your processing problems.

Eleven reviews of 20-MHz 386 systems follow, arranged alphabetically by manufacturer. With the exception of the Compaq Deskpro 386/20 and the IBM PS/2 Model 80-111, these machines were the first available for testing (see "The Fastest Ride Around," *PC Magazine*, January 26, 1988, and "IBM's PS/2 Model 80-111: A Dream Deferred," April 26, 1988, for reviews of Compaq's and IBM's models). Many more are sure to follow; almost every manufacturer of a 16-MHz 386 machine has plans to introduce a 20-MHz model sometime during 1988.

—Winn L. Rosch

OUR REVIEWERS

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ALR FlexCache 20386

How quickly they grow up. Every parent's lament also applies to Advanced Logic Research, a company that has quickly climbed to the top tier of compatible manufacturers. Like the company, the ALR FlexCache 20386 shows a new maturity, too. Equipped with a 20-MHz 80386, an 82385 cache controller, ALR's own FlexCache Dual Bus architecture, and an optional 80387 numeric coprocessor, this $7,490 hyperpituitary computer will give most minis a run for their money. It handily outperforms all of the machines reviewed here.

In fact, the big FlexCache 20386 tower, taller and wider than a PS/2 Model 80 at 25½ by 7½ by 17½ inches (HWD), is made for a minicomputer purpose. It's a perfect file server for those who don't want to venture into the exotic lands where DEC VAXs and IBM 9370s reign.

The design of the FlexCache 20386 shows that ALR has taken its server status to heart. This machine's mass storage accommodations are generous: one full-height and five half-height 5¼-inch drive bays. Only three of the half-height bays have front panel access, but the removable front panel can easily be modified (presumably at the factory, with a hacksaw or nibbling tool) to let all of the FlexCache 20836's drives peer out.

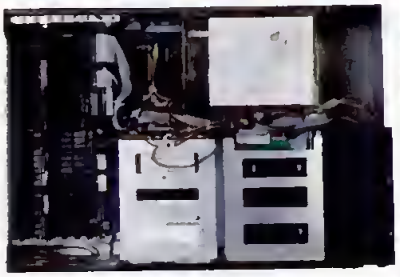
The top two bays are oriented horizontally, and as standard equipment one of them contains a 1.2MB 5¼-inch floppy disk drive. The remaining four bays tip their drives vertically. The evaluation machine also boasted an optional 1.44MB 3½-inch floppy disk drive.

The standard-equipment hard disk, a 150MB Control Data model (a $9,990 300MB system is also available) suits the server status of the FlexCache 20386 perfectly. It finds data quickly—due to its 18-millisecond average access time—and transfers it fast using the ESDI interface (good for a 10-MHz data transfer rate) and full-track buffering in its controller.

The FlexCache 20386 case is fabricated from heavyweight steel but has earned only an FCC Class A certification. A wide, flat metal foot widens the base to 11 inches. For access to the internal compo-



The $7,490 ALR FlexCache 20386 has a large amount of room for mass storage: three half-height and two full-height drive bays. The machine is an excellent file server, especially when equipped with the ESDI-controlled 150MB hard disk.



Photographs: Roberto Brosan

PC MAGAZINE FACT FILE

ALR FlexCache 20386
Advanced Logic Research Inc.
10 Chrysler
Irvine, CA 92718
(800) 366-2574
(714) 581-6770
List Price: Model 150 with 1MB RAM, 1.2MB floppy disk drive, 150MB hard disk, $7,490; Model 300 with 300MB hard disk, $9,990; EGA monitor and card, $998.
In Short: The floor-standing FlexCache functions best as a gigantic file server. Memory-caching tricks make it even faster than the Compaq Deskpro 386/20.
CIRCLE 672 ON READER SERVICE CARD

nents of the FlexCache 20386, the entire right side of its case removes after you loosen two capture screws (which are knurled so that you won't necessarily need tools).

The only front-panel control on the system is a keyboard and case cylindrical lock adjacent to the power and drive-activity indicators, all of which are embedded in the nameplate that separates the top two from the lower four drive bays. Despite the thick steel of the case, the mounting of the key-lock and the 3½-inch floppy disk drive proved to be less than sturdy: the drive and the lock had to be warped into place (moving them more than half an inch) in order to make the panel fit.

> Memory setup of the FlexCache 20386 involves more than running a program to update CMOS RAM. You've also got to flip the bank of eight DIP switches to tell the system what it's got inside.

HIDDEN SWITCH On the rear panel, the biggest novelty is the small metal door that hides the power switch. Another knurled capture screw secures access to the switch—a great idea for a network anchor, in which accidentally toggling the system off could crash a dozen nodes.

Below the door are the power supply connections: input and switched power-output jacks. You can select either 115- or 230- volt operation for the 200-watt power supply.

Near the middle of the rear panel are blanked cut-outs for three 25-pin D-shell connectors and two 9-pin. The keyboard connector also resides nearby.

At the bottom are the eight retaining brackets for the expansion slots of the FlexCache 20386. All of these slots will accommodate full-length, full AT-height expansion boards (one 8-bit, five 16-bit).

The last two are equipped as ALR proprietary "special 32-bit slots," notwithstanding their use of the same connectors as the AT slots. These slots must be used in pairs for 32-bit expansion—each 32-bit word of memory is split between the two cards. These slots are not compatible with standard 8- or 16-bit expansion cards. ALR offers a two-card expansion set consisting of a 2MB and an 8MB card, which gives a maximum capacity of 10MB to the system.

In the evaluation model, three slots were factory filled, all of them 16-bit. One held the WD1007 ESDI hard disk controller (which is capable of handling a second hard disk). A two-drive floppy disk controller and an EGA adapter with a built-in parallel port, both by ALR, filled two more slots. The floppy disk controller also hosted the system's standard-equipment parallel and serial ports.

SYSTEM BOARD The system board accommodates up to 72 DRAM chips in four 18-chip banks of sockets. The evaluation machine had two banks filled with 80-nanosecond, 256-kilobit CMOS dynamic RAM chips for 1MB of total memory. Filling the empty sockets pushes system board capacity to 2MB.

Logically, that RAM is divided into 640K for DOS, 256K extended. The balance—128K—of the first megabyte is used as shadow memory, speeding up ROM-based routines of the Phoenix BIOS, as well as those of the EGA BIOS. The FlexCache Dual Bus splits the 32-bit memory bus from the 16-bit AT-style I/O bus to allow a memory bandwidth of about 36MB per second while keeping expansion card speed down to about 3.5MB per second (so that PC expansion products will work).

The provisions for the microprocessor and its kin are unusual. The 80386, the cache controller, and a socket for the numeric coprocessor are all located on a daughterboard that plugs into a motherboard socket apparently used by the microprocessor in noncaching ALR computers. A total of 32K of fast (35-nanosecond) RAM is also installed on the daughterboard to serve as the cache.

The memory cache can be defeated or a few wait states can be added in order to slow the system down to 10 MHz for compatibility purposes. The slowdown is activated through a keystroke combination, by running a software utility, or through system setup.

MEMORY SETUP Unlike most AT-class machines, memory setup of the FlexCache 20386 involves more than running a program to update CMOS RAM. You've also got to flip the bank of eight DIP switches to tell the system what it's got inside. The switches, as well as the system-board power connectors, are accessed through a cutout in the plug-in microprocessor/coprocessor/cache board. ALR also includes Phoenix Technologies' Control/386 software (but not DOS) with the FlexCache 20386. The battery that keeps the setup memory and internal clock alive is rechargeable.

The 101-key Maxi-Switch keyboard supplied with the FlexCache 20386 follows the IBM Enhanced keyboard design with top-row function keys and separate cursor and numeric-cursor keypads. The system unit itself supplies electronically synthesized audible feedback with volume control from the keyboard. Also supplied with the evaluation unit was a Caspar TE5154 EGA display.

Compared with the Compaq Deskpro 386/20, the FlexCache 20386 does not seem as fast because its video speed is not as quick (Compaq uses its own 16-bit video card). But video speed doesn't hold back a file server, so the ALR FlexCache 20386 easily rates as a top choice for high-speed network applications.

—Winn L. Rosch

ADVANCED LOGIC RESEARCH INC.

ALR 386/220

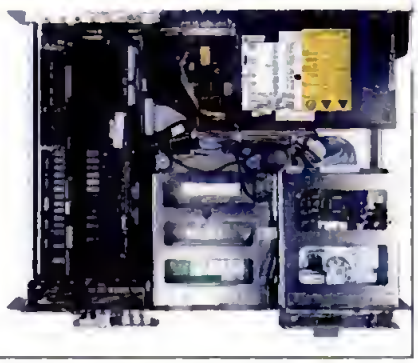
Advanced Logic Research has a second entry in the 20-MHz derby: the ALR 386/220. If the FlexCache 20386 is a technological thoroughbred, the 386/220 is a workhorse.

The 386/220 is an upgrade of the 386/2, ALR's 16-MHz 386 machine. Like its predecessor, it is configured as an AT-style machine with a floor-standing base attached.

What makes the FlexCache 20386 one



ALR's desktop 386, the 386/220, is slowed by two wait states imposed to keep the processor and the bus running together. A pair of proprietary 32-bit slots allows the installation of ALR's memory expansion boards. One megabyte of RAM is standard in the $2,495 base price.



PC MAGAZINE FACT FILE

ALR 386/220
Advanced Logic Research Inc.
10 Chrysler
Irvine, CA 92718
(800) 366-2574
(714) 581-6770
List Price: Model 10 with 1MB RAM, 1.2MB floppy disk drive, $2,495; Model 40 with 2MB RAM, 40MB hard disk, $4,485; Model 80 with 2MB RAM, 70MB hard disk, $5,185; Model 130 with 2MB RAM, 130MB hard disk, $7,794; EGA monitor and card, $998.
In Short: Rather than speeding up the system to match the 80386 processor, the 386/220 slows down the processor with wait states to match the system. The result is a machine of good quality that lags behind the rest.
CIRCLE **671** ON READER SERVICE CARD

of the fastest machines reviewed here and the 386/220 one of the slowest is their very different approaches to matching their fleet-footed 386 processors to more deliberately paced system speeds. The FlexCache uses a high-speed RAM cache to keep the system up to processor speed. The 386/220 slows the processor down by running it with two wait states, which idle the CPU while slower memory and disk operations catch up.

While it seems most 386s would rather die than be caught with their brakes on, ALR works to turn those wait states to an advantage, and it comes up with an interesting argument—compatibility.

The 386/220 is shipped with Phoenix Technologies' Control/386 software, which serves as a sort of majordomo to see that the 386 environment is made as pleasant as possible for applications running under DOS 3.*x*. It performs a variety of housekeeping chores, including backfilling main memory to 640K if necessary, emulating some 80286 instructions not in the 386 instruction set (even emulating "LoadAll" for the virtual 8086 mode), emulating EMS and EEMS in extended memory, and automatically slowing system speed during floppy-disk accesses—the better to soothe timing-sensitive copy-protection schemes. It does do one trick purely in the name of speed: it copies, or "shadows," the BIOS ROM (and EGA BIOS, if it can find it) into 32-bit RAM. The wider address space means quicker reads.

On the hardware side as well, the 386/220 is designed to be easy to deal with. Physically, it is an AT with an extra bit of pedestal on its left side, where a platform foot bolts on to make it floor-standing. Inside are the big Astec 200-watt power supply and drive bays for five devices. Three half-height slots on the right (or on top if it's sitting on the floor) open through the front panel, and a full-height bay sits to the left. On the motherboard are Phoenix

WHAT IS CACHING ANYWAY?

The performance improvements brought about by disk and memory caching are easily seen but not so easily understood. Here's how it works.

Caching can be used to improve a computer's performance whenever you have one type of memory storage that is slower than another. Quite simply, caching uses the faster memory medium to buffer input to or output from the slower one.

In *disk caching*, reading and writing to disk goes through a RAM buffer first. This cache retains the data after it has been sent to its destination. If the same information is requested again, it can be drawn from the cache instead of from the disk. Since RAM access is so much faster than disk access, there can be a substantial performance increase.

In *memory caching*, high-speed static RAM is used to buffer frequently requested data from slower memory storage areas—standard RAM or extended DRAM.

EXTENDED VS. STANDARD To access extended memory, your PC must switch into and out of protected mode. The BIOS software is responsible, so extended memory access is slower than standard RAM access. For this reason, we originally intended to test all caching software in normal memory in order to avoid any differences that are introduced by a particular machine's extended memory performance.

Unfortunately, the Phoenix Technologies caching software used in both of the tested ALR machines did not allow this option, so caching was set up in extended memory on all machines. This is probably where you would want to put your cache anyway, since that precious 640K of base memory can be put to better use by DOS and your applications. Even so, we saw a 30 percent performance increase on the HP Vectra RS/20 in some tests when using standard memory. This substantial performance increase was not found in the Compaq Deskpro 386/20 because its memory cache scheme negated the difference between standard and extended RAM access times.

CACHE SIZE Optimal cache size is a moving target at best. If you are using standard memory, you will want to keep the cache as small as possible. The best approach is to experiment with your applications as you reduce cache size in increments until it is low enough to induce a substantial drop-off in performance. If you frequently work with large records, such as word processing documents or spreadsheets, then a cache bigger than your larger files will give the best performance. If most of your work is with small records, such as those in database files, a small cache should be almost as efficient as a larger one.

If you use extended memory, there will be more memory to play with. A 256K cache is sufficient for most situations, but you still need to be sensitive to the tasks you perform. When we began our tests using a 256K cache, we got unexpectedly poor performance times when writing to cache, so we experimented with different cache sizes. Upping the cache size to 320K improved write times dramatically, while taking the cache to 1,024K helped only slightly more.

THE TRICKS UP HP'S SLEEVE Hewlett-Packard's Vectra Disk Cache Program gives the user total control without being overwhelming and yields the best power boost of the lot. With 11 different parameters to adjust, you are given control over not only the cache size and location but the blend of caching methods used. Each item has a default, many of which depend on whether the cache is being maintained in standard or extended memory.

You may shudder at the thought of write (as opposed to read) caching, since data written out to cache but not disk is volatile while it stays in RAM. But HP has taken a conservative approach. When writes are made, they are collected in cache memory until the next disk rotation brings the correct sector to the read/write head. Volatility is reduced to one disk rotation, with a gain in write speeds of at least 100 percent. The overhead introduced by this feature outweighs any gains, however, when large records are written out. In fact, performance is actually worse. If you won't tolerate even a little volatility, or if you typically write large records, HP allows this feature to be switched off.

HP's caching software can check the data being written out to see whether it is identical to data already written to the cache. If it is, the machine does not write to disk again. This trick saves another 20 to 30 percent if a lot of writing is being done. HP's program can also enable "batch transfers," which allow the caching software to stay in extended memory longer than normal. An additional performance gain should be achieved, but this feature may conflict with high-speed communications software.

USE IT NOW Caching works. It has been used in the mini and mainframe worlds for decades to help when disk access or memory access is slow. Now that both IBM and Apple have given their endorsement to the concept by offering their own versions, caching is finally catching on in the PC community. If caching software is supplied with your machine, use it, even if you can spare only a little RAM; you will still experience most of its benefits. If it is not supplied, consider getting one of the available third-party caching packages. You'll be glad you did.

—Philip F. H. Rose

Philip F. H. Rose is a PC Labs project leader.

The ALR 386/220's motherboard accepts up to 2MB of fast RAM. There are eight full-length AT-sized slots, and here things get interesting.

BIOS chips and sockets for 80287 and 80387 math coprocessors. The motherboard accepts up to 2MB of fast 80-nanosecond RAM (as 256 by 1 chips). There are eight full-length AT-sized slots, and here things begin to get interesting.

PROPRIETARY SLOTS The slots appear to be configured with six 16-bit and two 8-bit card guides. But the first two 16-bit slots are marked off with white on the motherboard as 32-bit slots. In effect they are treated by the system as a single, virtual 32-bit slot (just like what you see in the FlexCache). ALR's proprietary memory cards can carry up to 4MB, and, with two on the motherboard, the system supports 6MB of 32-bit memory. The only downside to this is that the two "32-bit" slots can't be used for anything else, which means that there's less real estate available inside the 386/220 machine than at first meets the eye.

The evaluation unit included a 1.2MB 5¼-inch Toshiba floppy disk drive and a drive controller that wore a serial and parallel port on its retaining bracket. A 40MB Microscience hard disk was connected to a second controller. An ALR-labeled EGA card drove a Casper color monitor that displayed an idiosyncratic sans serif character set. The keyboard that came with it was a 101-key Maxi-Switch unit in the IBM Enhanced style, but not in its class. An 80387 math coprocessor was installed, bringing the price of the configured system to $5,483. The user manual shipped with the 386/220 was written to cover the 16-MHz Model 386/2, but the real differences between them are very slight, and the manual does supply good, clear information on machine setup, jumper settings, and operation.

Although the 386/220 is not one of the fastest 20-MHz 386s, at a base price of $2,495 it is a solid bargain from a company that already has an established 386 product line—while many of its competitors are just getting their first machine out of the starting gate.—**David DeJean**

AMERICAN MITAC CORP.

Mitac Paragon 386

The Mitac Paragon 386 is a fairy-tale princess of a computer. It has a glass-slipper footprint—a marvelously tiny 15 by 16½ inches—and a grace of form and feature that draws a great deal of attention wherever it goes.

In a crowd of AT-sized 386s, the Paragon 386 looks positively dainty. (The machine is about 4½ inches narrower and an inch shallower than an AT.) But small size is hardly its only distinction. There are many good things in that small package, particularly a lot of good design work.

The $3,795 Paragon 386 is the most powerful member of a family of small-footprint machines from an established Taiwanese clone maker trying to establish its own name in the crowded American market. The Paragon line includes a 16-MHz 386 machine, two AT-class systems, and an XT compatible.

The intelligence evident in the design of these machines shines right from the front panel. Wonder of sensible wonders, that's where the power on/off switch and the keyboard connector are located, right along with the keylock, reset switch, and indicator lights. American Mitac Corp. press releases make much of "ergonomic design." Actually it's just good sense, but it's a commodity as rare in the computer business as . . . computers that don't make users dig around for power switches.

The front panel also hints at another feature of the Paragon 386's design: its extreme compactness. There are three disk drive openings in the front panel. Two are for standard half-height 5¼-inch devices. The third is just big enough to accept a 3½-inch drive turned on its side.

MINIATURIZATION Inside, the miniaturization becomes manifest. A smaller-than-usual 150-watt power supply leaves room for a special bracket to hold a 3½-inch hard disk at the right rear. The 3½-inch floppy disk also installs on a special bracket. This use of every nook and cranny means that despite its small footprint, the machine will support four storage devices. A Chips and Technologies VLSI CHIPSet helps cut the chip count on the motherboard. The space saved is devoted to memory (2MB is standard, expandable to 8MB) and to I/O (two serial ports and one parallel port, as well as the floppy disk controller, are all included on the motherboard).

The Paragon 386 has five full-sized slots, a number smaller than that of most machines in its power class. But with memory and I/O circuitry on the motherboard rather than filling expansion slots, the five slots (four 16-bit, one 8-bit) seem adequate: even with a video card and a hard disk controller installed, three slots are still free—as many as are left empty after configuring some of the eight-slot machines reviewed here.

The evaluation machine, priced at $5,495, came configured to run with no wait states. It had 2MB of 80-nanosecond RAM on the motherboard, and an 80387 math coprocessor installed. (A different model of the Mitac motherboard is available to accept an 80287 math coprocessor.) Two floppy disk drives were connected to the on-board controller: an Epson 1.2MB 5¼-inch and an ALPS 1.44MB 3½-inch. A Microscience 40MB hard disk was connected to a Western Digital 1003-WAH controller.

A proprietary EGA card drove a Mitac 12-inch EGA monitor, with very satisfac-

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Mitac Paragon 386
American Mitac Corp.
410 E. Plumeria Dr.
San Jose, CA 95134
(408) 432-1160
List Price: With 2MB RAM, 1.2MB floppy disk drive, $3,795; with 40MB hard disk, EGA monitor and card, $5,495.
In Short: The Taiwanese-built Mitac Paragon 386 squeezes 20-MHz power into a small-footprint box that can supply five expansion slots since vital ports reside on the motherboard.

CIRCLE 664 ON READER SERVICE CARD



By building essential ports into the motherboard, the $3,795 Mitac Paragon 386 doesn't sacrifice expansion potential in its small-footprint design. When configured with a 40MB hard disk and an EGA display, this single-user system is $5,495.



tory results. The 101-key proprietary keyboard was less satisfactory.

Benchmark tests showed that the Paragon 386 can keep up the pace despite its small size. While it's not built for screaming speed—it has no static-RAM cache or any other special go-fasters—it performs as well as do most of the other 20-MHz machines in the test group. It handles its video particularly briskly—a good trait in a machine that seems destined to be a desktop darling and run a lot of display-intensive software, like *Microsoft Windows/386*.

Construction of the American Mitac machine showed a neatness that matched the attention paid to its design. Sometimes things can get a little too compact: upgrading the system memory, for instance, means that the power supply will have to be pulled because it overhangs the territory on the motherboard where the SIMMs (single in-line memory modules) slide in. But such minor hassles are a small price to pay for a sleek machine that can do as much computing as the big boys on a piece of desktop only two-thirds their size.

—David DeJean

CORE INTERNATIONAL

Core ATomizer 386/20

Core International's first 20-MHz 386 offering, the ATomizer 386/20, is probably best described as an excellent hard disk surrounded by an average machine. Rather than innovating from the ground up, Core has assembled a 386 computer that may awe you with its speed but not with its technology.

Here's a partial checklist of what is to be found (and not found) under the cover of this $2,995 AT-style machine: an 8-bit AST 3-G EGA video card, a piggyback 32-bit memory card carrying 2MB of RAM, a hard disk controller using an OMTI chip set, four AA batteries to feed the clock/calendar mounted on the side of the 200-watt power supply, a serial card, a 1.2MB high-density Mitsubishi 5¼-inch floppy drive, plenty of room for an internal hard disk and two floppy disk drives out front, an 80287 socket, and, of course, the 20-MHz 80386 microprocessor. Like some other 386 machines that have been assembled off-the-shelf as opposed to designed from scratch, the ATomizer has no surface-mount technology, no SIMMs (single in-line memory modules), no 80387 socket, and no memory caching.

Core is preparing to ship its own cache controller in May with caching for both Novell's networking software and DOS. Free device drivers already come on the

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Times Have Changed.

controller's removable EPROM with any hard disk purchase; it includes drivers for Novell's *NetWare* 2.1, 3Com, *Windows/386*, SCO Xenix 286/386, and Core's Gigafile Extender.

The Phoenix BIOS that Core supplied with the machine when it was first introduced was replaced last quarter because it did not support Novell's networking software. Its current replacement is an Award BIOS that left our evaluation unit with an essentially blank and frozen screen for some 50 seconds during boot-up—that's from power-up to prompt. A spokesperson at Core explained that a free Award BIOS upgrade is now available for owners with Award BIOS chips.

To be fair, other than the slow boot-up, the current Award BIOS doesn't seem to have any negative effect on DOS functions or on any of the standard word-processing or spreadsheet software that PC Labs tested with the ATomizer. In fact, the machine ran all of the PC Labs benchmark tests without failure or errors.

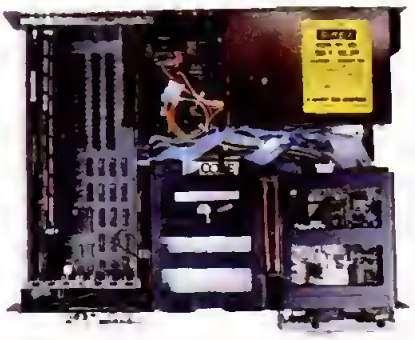
TEST RESULTS Although it handled the standard processing, file, and disk access tests with middle-of-the-road speed, the ATomizer was last in the video BIOS routines. The performance of the fine $600 Core EGA Monitor was hampered by the slow video card (new on the market about 3 years ago). However, performance was significantly enhanced with a Core-provided program (RELOCATE .EXE) that relocated EGA and BIOS from the EPROM to RAM and yielded test results of 7.86 seconds for Direct to Screen, 6.54 seconds for Video BIOS with Scrolling, and 3.18 seconds for Video BIOS Without Scrolling.

As of this writing, VGA is not supported. Core says that the ATomizer can be shipped with your choice of video card or with none at all in case you want to do your video shopping elsewhere.

Our evaluation unit was accompanied by a $1,900 90MB Core hard disk, the HC



The Core ATomizer 386/20, priced at $2,995, is most notable for the excellent performance of its 18-millisecond 90MB hard disk (a $1,900 option). Otherwise, it is an AT-style machine, with the advantage of a 32-bit expansion slot for fast memory upgrades.



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Core ATomizer 386/20
Core International
7171 N. Federal Hwy.
Boca Raton, FL 33487
(305) 997-6044
List Price: With 2MB RAM, one 1.2MB floppy disk drive, $2,995; 2MB RAM expansion, $400; EGA monitor and card, $600; 40MB hard disk, $876; 90MB hard disk, $1,900; 150MB hard disk, $2,796; 310MB hard disk, $4,796; 380MB hard disk, $5,196.
In Short: Core's 20-MHz 386 breaks no new ground technologically. Performance falls in the middle of this rarefied group. Disk performance is first-rate. Core sells EGA monitors and cards; like all fast 386s, this machine deserves a fast VGA card and monitor.
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The compatibility that DesignCAD 3-D offers you means that it can be used with almost any PC compatible system. It supports more than 200 dot matrix printers, more than 80 plotters and most digitizers and graphic adapters. DesignCAD 3-D can read drawings from most other CAD systems.

The best reason to buy DesignCAD 3-D is not the low price, the performance or the compatibility. The best reason is the amazing ease of use. DesignCAD 3-D's powerful commands mean that you can produce professional 3-D drawings in less time than you thought possible. In fact, we think you'll agree that DesignCAD 3-D is easier to learn and easier to use than any 3-D CAD system for IBM PC, at any price!

See your local computer dealer for DesignCAD 3-D, or contact:

PC Resource Magazine has listed DesignCAD 3-D as one of the six new computer products worth watching in 1988.

American
Small Business Computers, Inc.

327 S. Mill St., Pryor, OK 74361
(918) 825-4844 FAX 918-825-6359
Telex 9102400302

CIRCLE 475 ON READER SERVICE CARD

90, that topped the BIOS Disk Seek test among the other machines in this review, turning in an average access time of 18 milliseconds. That's an important consideration if the ATomizer is used as Core suggests it should be: as a desktop publishing unit, network server, or workstation. Core offers several other high-capacity, high-performance hard disks ranging all the way up to 310MB as well.

The 101-key IBM Enhanced-style keyboard is not unlike those found with Dell Computer machines: loose and clicky.

UNUSUAL SLOT LAYOUT The full-size AT chassis contains plenty of expansion slots, though the arrangement is a bit unconventional: from left to right, the motherboard is configured with a 16-bit slot, a 32-bit memory slot, an 8-bit slot, three 16-bit slots, another 8-bit slot, and another 16-bit slot—eight slots all told, with four free after adding video, I/O, disk controllers, and memory. Unfortunately, the pressed-cardboard short-out shield on the back of the memory card intrudes on the 8-bit slot space next to it. Although you can muscle a card in next to the 32-bit slot, it's a tight fit, and the card is then difficult to remove. A diagnostic light mounted to the motherboard warns you of trouble with the bus, but if you've got a card in the 8-bit slot you won't see it. As far as the AA clock batteries go, there's nothing wrong with them; it's just that most manufacturers use long-life nickel-cadmium or lithium batteries these days.

The Core's full-size AT chassis contains plenty of expansion slots, though the arrangement is a bit unconventional.

What's in the future? According to Core, a new motherboard is currently under design that will include an 80387 socket and will be ready, at the earliest, in August or September. In addition, surface mounts will appear on some of their drives, specifically on the 90MBs. The company is planning on sticking with the AT bus, and a change to lithium clock batteries is coming.

Core notes that it's a hard disk manufacturer, not a desktop computer maker. It's been in the systems business since early 1986 and has shipped them seriously only since 1987. The ATomizer 386/20 is a fully workable and functional machine, but if Core is serious about carving out a slice of market share, it should try to elevate the rest of the system to the technological level of its uniformly excellent hard disks.—**Greg Pastrick**

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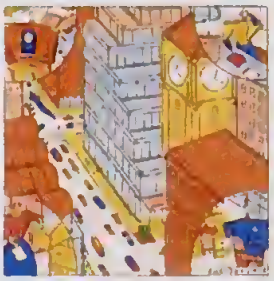
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*Suggested Retail Price

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HEI Turbo 386

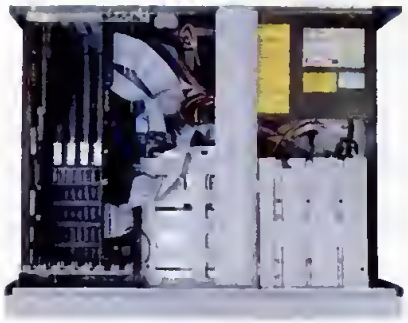
If there were zoning ordinances among PCs, the HEI Turbo 386, from Herko Electronics, is something that you might expect to see more of: a low-rise tower. Shorter and squatter than a floor-standing PS/2, although about the same volume (21 by 7 by 16¾ inches [HWD]), the $4,829 Turbo 386 packs in a greater number and variety of mass storage options. That, along with the system's 20-MHz speed and memory cache, makes the Turbo 386 a candidate for server-style applications—but with important limitations.

Among its mass storage accommodations are three 5¼-inch half-height drive bays with front-panel access, stacked near the top of the front panel. Additionally, a single full-height internal bay awaits one of a variety of factory-supplied hard disks, starting at the 64MB standard equipment unit. The review machine's hard disk capacity was actually 108MB, achieved through use of a Micropolis 71MB hard disk and an RLL (run-length-limited) controller.

Despite the vertical alignment of the case, all drives install horizontally (no worry about which way to slide in a floppy disk) except for the hidden hard disk, which installs vertically, much like the internal drive of an AT.



HEI's tower-style Turbo 386 includes 1MB RAM and a 64MB hard disk in its $4,829 base price. The lack of 32-bit expansion capability cramps its performance, but one full-height and three half-height drive bays give the tower ample mass-storage potential.



FACT FILE

HEI Turbo 386
Herko Electronics Inc.
4655 Ridge Rd. West
Spencerport, NY 14559
(716) 352-1102
List Price: With 1MB RAM, 1.2MB floppy disk drive, 64MB hard disk, monochrome monitor, $4,829; with 108MB hard disk, $5,269; 3MB RAM expansion, $1,480; VGA monitor and card, $898; 80387 coprocessor, $1,088; 1.44MB 3½-inch floppy disk drive, $152; 60MB tape drive, $802; I/O card with 2 serial ports, 1 parallel port, $83.
In Short: The tower-styled Turbo 386 is a fast performer, but the lack of 32-bit expansion potential and a poorly designed coprocessor connection prevent it from rising to the top tier of 20-MHz machines.
CIRCLE 669 ON READER SERVICE CARD

Herko allows several drive options in the top slots, including double-density and high-density 5¼-inch floppy disks, 720K and 1.44MB 3½-inch floppy disks, and a QIC-40–style DC2000 tape backup system is also included.

The case of the Turbo 386 is made from heavy-gauge steel and gives a very sturdy feel to the 43-pound system unit. A steel bar across the midsection inside makes the case extremely rigid. Overall, it's probably stronger than 95 percent of the microcomputer cases on the market. It has an FCC Class A certification.

Near the top edge of the front panel of the Turbo 386 is a horizontal line of controls. From left to right, you'll find a cylindrical system and keyboard lock, a hard disk activity indicator that doubles as a turbo switch, a reset switch, and the power switch.

The keyboard connects in the rear,

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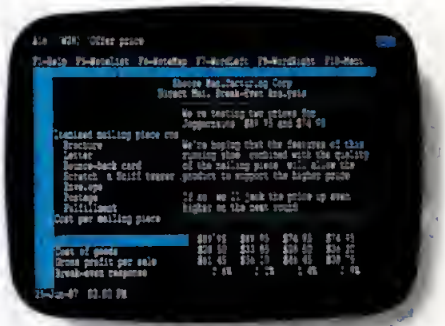
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(Products listed in ascending base-price order)

BASIC CONFIGURATION	VIPC 386 Colossus	ALR 386/220	Logix LGX 386	Core ATomizer 386/20	Proteus 386 A-20	Micro 1 Power 386	Mitac Paragon 386	HEI Turbo 386
Price	$1,999	$2,495	$2,495	$2,995	$3,190	$3,495	$3,795	$4,829
RAM	1MB	1MB	2MB	2MB	1MB	1MB	2MB	1MB
Floppy disk drives	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB	One 1.2MB
Hard disk drives	None	None	None	None	None	49MB	None	64MB
Clock/calendar	●	●	●	●	●	●	●	●
Software	Setup in ROM	Control/386	None	DOS 3.3 or Xenix	Diagnostics in ROM	DOS 3.3	DOS 3.2	DOS 3.3, menu generator
Monitor	None	None	None	None	None	Monochrome	None	Monochrome
Ports	2 serial, 2 parallel	1 serial, 1 parallel	1 serial, 1 parallel	1 serial, 1 parallel	2 serial, 1 parallel	2 serial, 1 parallel	2 serial, 1 parallel	1 parallel
Slots	1 32-bit, 6 16-bit, 1 8-bit	2 32-bit, 4 16-bit, 2 8-bit	2 32-bit, 4 16-bit, 2 8-bit	1 32-bit, 5 16-bit, 2 8-bit	6 16-bit, 2 8-bit	6 16-bit, 2 8-bit	4 16-bit, 1 8-bit	6 16-bit, 2 8-bit
Power supply (watts)	220	200	200	200	200	200	150	192
Reset switch	●	○	●	●	●	●	●	●
Keyboard style	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced	IBM Enhanced
CONFIGURATION TESTED								
Price	$9,999	$5,483	$6,305	$5,771	$6,003	$7,593	$5,495	$9,772
Configuration	4MB RAM, 80MB hard disk, 1.44MB 3½-inch floppy disk, 80387 co-processor, NEC MultiSync monitor	40MB hard disk, EGA monitor	2MB RAM, 72MB hard disk, 1.44MB 3½-inch floppy disk, 80387 co-processor, Zenith flat tension mask monitor, mouse, DOS 3.3	90MB hard disk, EGA monitor	4MB RAM, 44MB hard disk, 1.44MB 3½-inch floppy disk, EGA monitor	4MB RAM, 88MB hard disk, 1.44MB 3½-inch floppy disk, 80387 co-processor, NEC MultiSync II monitor, Logitech mouse, *Microsoft Windows/386*	40MB hard disk, EGA monitor	4MB RAM, 108MB hard disk, 60MB tape backup, 1.44MB 3½-inch floppy disk, 80387 co-processor, VGA monitor
SPECIFICATIONS								
Clock speed (MHz)	6/8/10/20	10/20	10/20	4.77/6/8/12/20	6/20	6/20	20	16/20
Controller card handles	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 1 hard disk drive	2 floppy and 2 hard disk drives
32-bit memory implementation	Expansion slot	1MB on motherboard, extra memory in slot	Expansion slot	Expansion slot	Motherboard	Motherboard	Motherboard	Motherboard
Math coprocessor	80387	80287 or 80387	80287 or 80387	80287	80287; optional 80387 mount card, $200	80287 or 80387	80387	80387
RAM chips	Static column	Dynamic	Dynamic	Static column	Dynamic	Dynamic	Dynamic	Dynamic
OTHER								
Warranty	1 year	1 year	9 months	1 year, 3 years on disk	15 months	1 year	1 year	1 year, 90 days on-site
BIOS manufacturer	Award	Phoenix	Phoenix	Award	AMI	AMI	Phoenix	AMI
FCC certification class	A	A	A	B	B	B	B	A

—Editor's Choice ●—Yes ○—No

	IDR 386 Workstation	ALR FlexCache 20386	HP Vectra RS/20
	$4,995	$7,490	$7,495
	2MB	1MB	1MB
	One 1.2MB	One 1.2MB	One 1.2MB
	40MB	150MB	40MB
	●	●	●
	DOS 3.3	Control/386	DOS 3.2, HP's *Personal Applications Manager, Microsoft Windows* 2.0, DOS 3.0 multitasking, disk caching
	None	None	None
	2 serial, 1 parallel	1 serial, 1 parallel	1 serial, 1 parallel
	3 16-bit	2 32-bit, 5 16-bit, 1 8-bit	2 32-bit, 6 16-bit, 2 8-bit
	130	200	200
	●	○	○
	IBM Enhanced	IBM Enhanced	IBM Enhanced
	$5,495	$8,488	$10,335
	40MB hard disk, 80387 coprocessor, NEC MultiSync monitor	150MB hard disk, EGA monitor	100MB hard disk, EGA monitor
	8/20	10/20	8/20
	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives	2 floppy and 2 hard disk drives
	Motherboard	1MB on motherboard, extra memory in slot	Expansion slot
	80387	80387	80387 or Weitek 1167
	Dynamic	Dynamic	Dynamic
	1 year	1 year	1 year
	IDR	Phoenix	Phoenix
	A	A	B

about halfway up. Near the top of the rear are jacks for power input and switched power-output for controlling a video display or another accessory. Moreover, there are five cutouts for I/O connectors: three are for 25-pin and two for 9-pin D-shell connectors.

To get inside the case of the Turbo 386, slide the one-piece cover (which wraps around three sides of the system) backward from the front panel. Inside you'll find the system layout is much like any AT clone's, in this case built around an American Megatrends motherboard.

Besides containing the 20-MHz 80386 chip and a DIP socket for an 80287 numeric coprocessor, the AMI board accommodates up to four nine-chip banks of either 256-kilobit or 1-megabit DRAM chips, all of which are socketed. Although 1MB is standard, the evaluation machine was filled with 36 100-nanosecond megabit chips to yield 4MB. This memory was split into 640K for DOS, with the remainder as extended memory.

To help the memory keep up with the 20-MHz microprocessor, HEI uses a 64K memory cache with a proprietary control system (not an 82385). The advantage of the cache is obvious. For raw processing power, the Turbo 386 proved to be among the fastest machines tested, on a par with the Compaq Deskpro 386/20.

The AMI system board is equipped with eight expansion slots: two 8-bit and six 16-bit. Because no 32-bit expansion memory is available, only system board memory can deliver the top performance of the machine.

Standard equipment fills one slot with a monochrome display adapter and another with an Adaptec combined hard/floppy disk controller. A parallel port is built into the display adapter. The hard disk section of the controller in the evaluation system used RLL (run-length-limited) data coding to squeeze 50 percent more data onto the disk and push the data transfer rate between the system and drive up to 7.5 MHz.

The evaluation system was also equipped with two other optional boards. One, an 8-bit short card, was the controller for the also-optional cassette-based tape backup system. The other held the system's optional 80387-20 numeric coprocessor.

UNUSUAL ARRANGEMENT Besides being able to fit into an 8-bit expansion slot, the board that contains the 80387 also has two cables leading to the system board. One plugged into the 80287 socket; the other, a thin band of ribbon, found a home adjacent to the system ROM. This unusual coprocessor arrangement sacrifices speed. The 80387s of some other, slower 80386s tested here were able to crunch numbers more than 25 percent faster. At the prices charged for high-speed 80387s, this installation arrangement amounts to an expensive waste of power.

The AMI BIOS used by the system includes its own built-in setup and diagnostic routines, which are accessible from the keyboard while the machine is booting up. In addition, you may find yourself flipping through a bank of eight DIP switches to set the system up; for instance, to indicate the type of memory chips with which the system is equipped and the type of monitor that's connected. DOS 3.3 and a menu-generator program are included in the standard configuration.

At the upper rear of the chassis is a 192-watt power supply. A slide switch that's accessible from the rear panel allows you to select either 115- or 230-volt operation. A nonrechargeable lithium battery stuck to the rear panel runs the system board clock and keeps its CMOS configuration memory alive.

The HEI keyboard arrived nonfunctional, and the power-on self-test of the Turbo 386 correctly reported its failure. When operational, this keyboard has a remarkably good feel, with snap-over-center action and a faintly audible keyclick. It follows the IBM Enhanced design.

In place of the standard-equipment monochrome display adapter, the evaluation system was equipped with an Everex EVGA video card that connected to a Magnavox Professional MultiSync–style display. Although it performed somewhat slowly, the Everex-based VGA system proved a close (but not perfect) hardware match for PS/2 video. The total price for the heavily configured evaluation system was $9,772.

Overall, the Turbo 386 is a machine of good raw performance that is constrained by design oversights: a lack of 32-bit expansion memory and a crippled co-

processor. Consider it for smaller server applications only or as a powerful deskside single-user computer.—**Winn L. Rosch**

HEWLETT-PACKARD CO.

HP Vectra RS/20

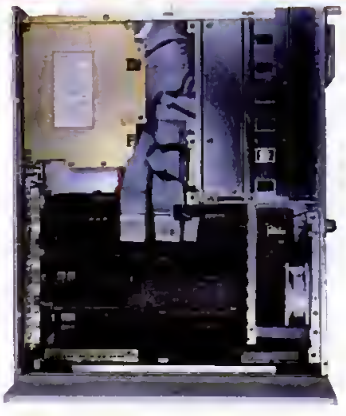
Scratch a Hewlett-Packard minicomputer user, and you'll turn up the most brand-loyal customer in the computer industry. When it comes to the PC market, that loyalty has been HP's most important asset. The company's slightly offbeat PCs (surely you remember the HP 110 laptop and the still-available Touchscreen PC) haven't exactly made it to the top of the charts in normal distribution and retail channels. Consequently the company has had to mine most of its PC sales from its loyal customer base.

If the new HP Vectra RS/20 ($7,495) is any example, that's about to change. The floor-standing RS/20 is top dog in the company's Vectra line of PCs. The first thing you notice is the injection-molded plastic case. It's handsome, if a bit big and bulky, and has the well-put-together look common to HP products. That image is bolstered when you take the case off to install your options and see the inner shell of galvanized steel. First you'll wish your car was made of steel this good; second, you'll understand why the big HP weighs so much. The steel shell also makes a dandy RF shield—and probably protects the machine from serious damage when it gets a swift kick from an irate user.

Few if any Vectra RS/20 users will be irate, however. Like the other machines in this review, the RS/20 sports a 20-MHz 80386 Intel microprocessor. In the configuration tested, the RS/20 also included a world-class, 19-millisecond-access-time ESDI-controlled 100MB hard disk made



The Editor's Choice HP Vectra RS/20 can be configured with up to 620MB of mass storage managed by an ESDI controller that yields an average access time of 19 milliseconds. Up to 16MB RAM can reside on the motherboard.



EDITOR'S CHOICE

FACT FILE

HP Vectra RS/20
Hewlett-Packard Co.
3000 Hanover St.
Palo Alto, CA 94304
(415) 857-1501
List Price: Model 40 with 1MB RAM, 1 1.2MB floppy disk drive, 40MB hard disk, $7,495; Model 100 with 2MB RAM, 100MB hard disk, $8,995; Model 150 with 2MB RAM, 150MB hard disk, $9,995; Model 300 with 2MB RAM, 300MB hard disk, $11,995; 1MB RAM expansion, $695; EGA monitor and card, $1,340.
In Short: The HP Vectra is a high-performance PC with a classy steel chassis, an outstanding hard disk, and plenty of room for expansion. The floor-standing unit is an excellent candidate for a network file server.

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CIRCLE 300 ON READER SERVICE CARD

by HP, along with caching software to make it run even faster. System memory consists of 70-nanosecond interleaved DRAM installed on the planar board in the form of 256K SIMMs (single in-line memory modules). Standard configuration is 2MB, but the planar can use 1-megabit SIMMs and have up to 16MB of RAM installed. The planar also supports a 80387 or Weitek math coprocessor and has room to spare should HP engineers decide to add more features.

The RS/20's AT-standard 16-bit I/O bus is on a separate circuit board hooked up at a 90-degree angle to the planar. The bus has six 16-bit and two 8-bit slots, as well as a custom slot for the keyboard and proprietary HP mouse interface. Two custom slots for additional 32-bit memory are available on the planar board. HP also supplies a compatible Logitech-built mouse with the RS/20.

PERFORMANCE ISSUES While the RS/20's processor and memory performance are not at the top of the list, they're close enough for most single-user purposes. The performance of the big HP just makes more obvious the need for a fast memory cache to support the kind of memory access demands made by a 20-MHz processor. Using 70-nanosecond RAM chips just doesn't do the job, and I'm hard pressed to understand why, with excess real estate on the planar board, HP does not use the Intel 82385 controller and a static RAM cache such as the one used by ALR and Compaq.

Meanwhile, the awesome size and performance of the HP-manufactured hard disk should make the RS/20 an easy first choice as a network server. The standard configuration consists of a 1.2MB 5¼-inch floppy disk drive and a 40MB full-height hard disk. Up to two 310MB disks can be loaded into the RS/20 and operated by the ESDI controller, and the Vectra's three full-height disk bays give you plenty of room to configure whatever disks or tapes you want to install. The 1.44MB 3½-inch microfloppy disk drive installed on the machine I tested was the one piece of HP-supplied equipment that gave consistent problems. This drive could not read disks formatted by any of the other drives in PC Labs, although they could all read disks that were formatted by the HP.

HP includes DOS 3.2 (to be upgraded to DOS 3.3 by the time you read this) and some extra utility software. Besides the disk caching software, there's a copy of HP's *Personal Applications Manager*, and a device driver for LIM 4.0 simulation that converts the system's extended memory into expanded memory. The company is shipping OS/2, Version 1.0, for the Vectra line; its price is $325.

The excellent quality of HP's EGA display was expected, but the Vectra's keyboard was a big surprise to me. When I first checked it out by tapping random keys, it had the mushy feel of a Compaq keyboard that IBM keyboard lovers like me can't stand. However, after I used it for a few days, the board's well-sculpted keytops began guiding my fingers to just the right places and landing them comfortably all the time. The Vectra keyboard might someday make me a permanent defector from IBM's clickity-clack touch.

In general, the Vectra RS/20 offers magnificent ergonomics, looks, and assembly quality, all for a reasonable price. Its performance isn't quite up to where it could be, but now that I have tried several 386 machines on for size, this is the first one that seems destined to stay within reach of my desk.—**John Dickinson**

IDR INC.

IDR 386 Workstation

The power-hungry executive will have the perfect desktop companion in the IDR 386 Workstation.

Roughly the size of a PS/2 Model 50 (5 by 14 by 15½ inches [HWD]) but packing the power of a 20-MHz Model 80, this American-made miniature brings the additional benefit of the hardware and software compatibility of an AT.

Sacrificed for the compact packaging of the $4,995 computer are your mass storage options. The 386 Workstation has room for just two 5¼-inch half-height drive bays, both of which come factory prefilled. At the top of the left side of the case is a slot for a 5¼-inch 1.2MB floppy disk drive. Beneath it, hidden by a nonremovable section of the plastic front panel bezel, is a Microscience hard disk with a nominal 40MB capacity and 30-millisecond (tested) average access time. The drives are directly screwed to the sides of the bay, four screws holding the hard disk in place. Expansion slots are somewhat limited, too. Only three 16-bit slots are available, all full AT height and full length. There are no provisions for 32-bit expansion.

The trick to squeezing full-size slots into a pint-sized computer is turning them on their sides, with the expansion connectors running up the right side of the chassis. In the standard configuration, all three slots were vacant, with the I/O ports, the EGA video adapter, and the floppy/hard disk controller built into the system board circuitry. All of these system board functions can be defeated to avoid conflicts with expansion hardware.

The only problems with this design are the two inches of clearance above the retaining bracket screws (which means you'll need an awfully short screwdriver and a contortionist to slide the cards into place) and that getting to the bottom card requires removing any others installed in the slots above it. IDR should include a right-angle screwdriver with the 386 Workstation.

While the front panel might be mistaken for a shrunken, left-handed AT, it's just plain enough to be attractive and functional. Adjacent to the floppy disk drive are the mandatory hard disk activity and power indicators and the power switch. Ventilation is afforded by a recessed row of vertical slots around the bottom of the bezel.

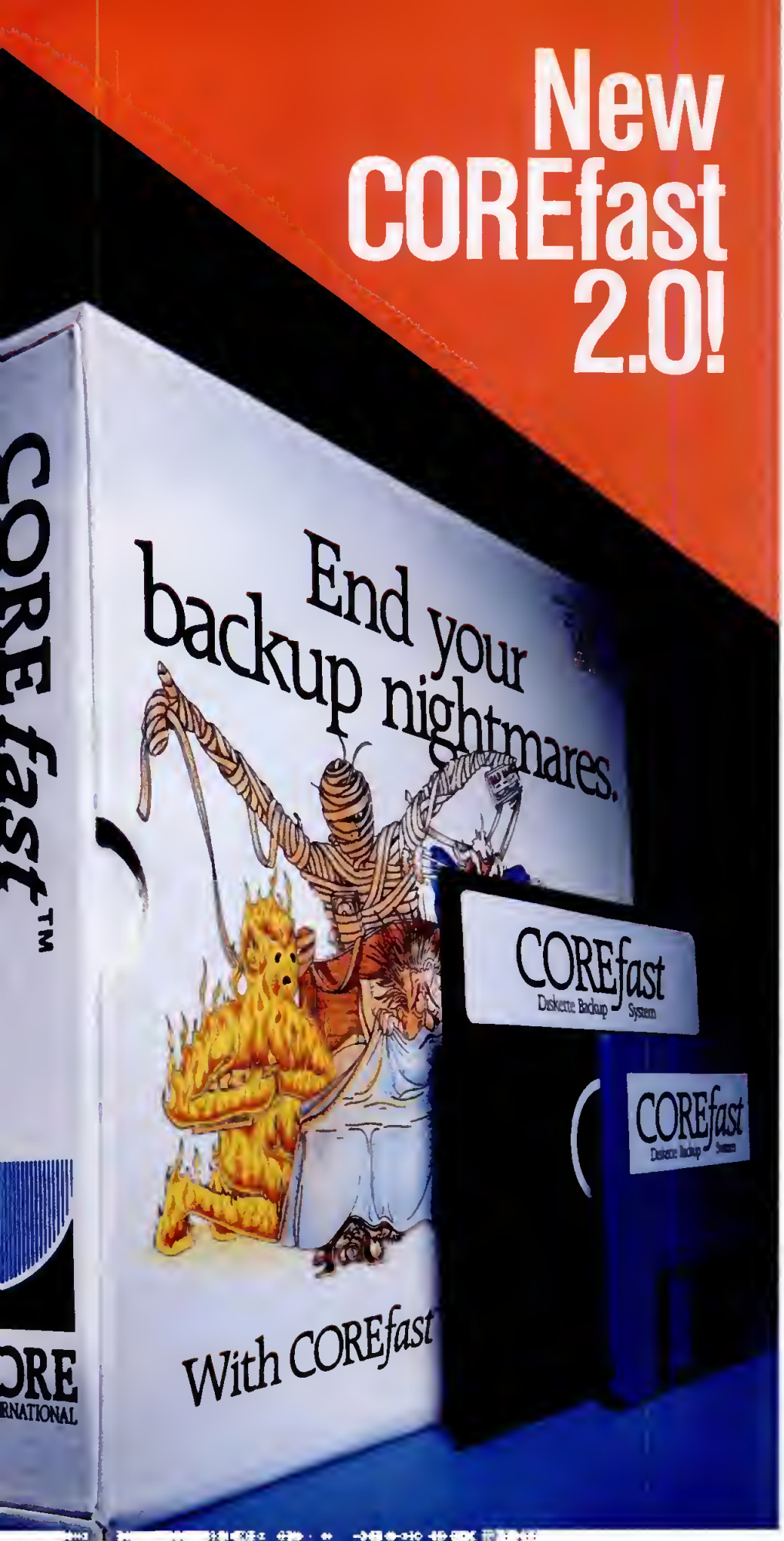
The vital I/O connectors run as a low

FACT FILE

IDR 386 Workstation
IDR Inc.
370 Vanderbilt Motor Pkwy.
P.O. Box 13008
Hauppauge, NY 11788
(516) 434-1900
List Price: With 2MB RAM, 1.2MB floppy disk drive, 40MB hard disk, $4,995; NEC MultiSync monitor and card, $500.
In Short: It looks like a PS/2 Model 50 but performs like the Model 80. If you want the ultimate in computing power on your desk and don't need lots of peripherals or mass storage, the 386 Workstation is worth a look.

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CIRCLE 372 ON READER SERVICE CARD



The IDR 386 Workstation offers the power of the PS/2 Model 80 in a box the size of the Model 50. The $4,995 machine is cramped inside, with room for just three 16-bit expansion slots and two half-height drive bays—enough, perhaps, for a single user, but not enough for the machine to act as a file server.



belt-line across the rear panel of the system. There you'll find a wealth of miniature D-shell connectors: a female 9-pin for video, a female 25-pin for the parallel port, a pair of male 9-pins for the two standard serial ports. Above the last of these is a reset switch and, above that, the keyboard connector. At the far left of the rear panel are the power-in and switched power-output connectors.

The FCC Class A–certified case slides forward and off like that of an AT, and it's secured by just one screw. That's all that's necessary because the fit is very tight. Inside, you'll find everything neatly arranged and packaged. All wires are bundled and clipped in place.

At the left rear of the 386 Workstation chassis is the small (like everything else) 129.7-watt power supply. As with current IBM units, this one automatically configures itself for whatever voltage is available—115 or 230 volts—without switches. Although somewhat meager, it should be sufficient considering the lack of expansion potential.

MOTHERBOARD DESIGN The motherboard of the 386 Workstation is simply a bus card that contains four AT-style slots: the three expansion slots plus one used by the large system board that fills the entire bottom of the small chassis. A number of connectors and other appendages attach to this board. At the rear, the I/O connectors reside on a small circuit board that's cabled to the system board. Hidden under the drive bays are the connectors for the drive controller.

Most of the circuitry of the 386 Workstation is implemented with the Chips and Technologies 20-MHz AT CHIPSet. Memory is interleaved to deliver zero wait states, although not invariably. System RAM comprises eight banks of 256K SIP-style memory modules, all rated at 100 nanoseconds.

Normal system operation is enhanced by so-called shadow memory: the 386 Workstation copies its BIOS routines from slow ROM into fast 32-bit RAM.

A socket on the motherboard can contain an optional 80387 numeric coprocessor. It's large enough to accommodate something more exotic, like a Weitek chip, and code for same appears in the BIOS. The batteries for the system board clock and CMOS configuration memory are also mounted on the system board as a stack of two half-dollar-size lithium button cells.

Electronically written into the BIOS code is a message attributing the copyright to Up To Date Technology, as well as the mysterious message, "Reuter Schwarz A Tron" (IDR is a Reuter company). According to the instruction manual, system setup requires running the program from a

floppy disk, as well as configuring the hardware switch and jumper settings; however, a setup procedure appears to be built into the BIOS code, too.

Notwithstanding its strange internal messages, this BIOS seemed well behaved and did not demonstrate any overt incompatibilities. It supported all IBM-standard floppy disks, including 1.44MB 3½-inch drives. DOS 3.3 comes with the 386 Workstation.

The IDR 386 Workstation's system board video adapter accommodates any display short of a VGA. It can be set up with switches or run on autopilot, sense the monitor type plugged in, and configure itself.

The Key Tronic keyboard supplied by IDR follows the IBM Enhanced design. Its over-center touch is very positive—too much so, in fact. The Spacebar, for instance, requires applying inordinate pressure. If you type a lot, you just might callous your thumb.

The system board video adapter accommodates any type of display short of a VGA. It can be set up either with switches or run on autopilot. It can sense the type of monitor plugged into it and configure itself appropriately. The system board video adapter can also be defeated in favor of some other adapter in an expansion slot. IDR supplied a NEC MultiSync with the evaluation unit.

The standard $4,995 IDR 386 Workstation gives you just about everything you'd get with a Model 50, except for a few backward steps in the hardware—substituting the AT standard for Micro Channel, EGA for VGA, a 5¼-inch floppy disk for 3½—yet puts you a big performance jump ahead. Even though it's among the slowest machines reviewed here, it's well built and endearingly elegant enough to deserve serious consideration.—**Winn L. Rosch**

PC LABS BENCHMARK UPDATE

As PC technology continues to improve, PC Labs continues to revise its benchmark tests to measure the benefits of the changes.

PC designers and engineers are constantly changing the rules: each advance in technology comes with a new game plan and a new squad of players to set things in motion. That's to your benefit because those changes usually lead to higher performance at a lower price. But as a consequence of those changes, PC Labs has to check its benchmark test programs constantly to make sure that they are still in the same game with the devices they are measuring. Sometimes they're not—and then they have to be changed.

Hard disk drives are a recent beneficiary of major technological advances, including higher-speed controllers, RLL drivers, and caching software. To reflect these advances, the PC Labs disk benchmark tests are getting a new look—starting with the ones in this article.

The old benchmark tests concentrated on measuring the actual speed of the disk drive itself. Now, however, the newer disk-controller and software technology allows physically slow disks to perform in the same league with their faster brethren by moving data into DOS memory faster. The new benchmark tests gauge this performance improvement by measuring how fast DOS receives the data from the disk—a factor that is generally known as *data throughput*.

The new entries you see in the benchmark-test results here are versions of the DOS File Access test, which measures a disk's throughput. There are two versions of the test: one for files containing large records (such as word processing files), and one for files containing small records (such as database files).

The File Access test, which consists of five tasks, is performed on both types of records using standard DOS function calls. First the test measures the time it takes to sequentially create and write a file, then it performs a sequential read of the same file, then a random read and a random write. The results (in seconds) are summed and printed in the table. It goes without saying that disks performing these tasks in less time are performing relatively well.

The File Access test is designed to show the results of software performance enhancements. Since so many new PCs are coming equipped with caching software, we're running the File Access test (for both record sizes) with and without the caching software installed. Thus you can see how effective each vendor's software is.

We will continue to publish the BIOS Disk Seek test results in the past. This test uses BIOS interrupt 13h, function 0Ch, to measure the time (in milliseconds) it takes a disk to seek data physically. The results are comparable to the "average access time" printed in most disk drive ads.

Normally we will no longer publish the results of the DOS Disk Access test. This test uses DOS interrupt 25h to measure disk seek time, and the results are approximately comparable to the BIOS Disk Seek test results. The DOS Disk Access test is useful when the computer being evaluated has an incompatible BIOS and cannot perform the BIOS Disk Seek test; we will continue to publish the results of the DOS test in such cases. A footnote will indicate the difference.

If you want to see for yourself how effective disk caching software can be, get the newest edition (Version 4.10) of the PC Labs Benchmark disk and run it with and without caching software on your own PC. Hang on to your hats—the results may surprise you!

—**John Dickinson**

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Keith Ferrell COMPUTE!'s PC, March, 1988

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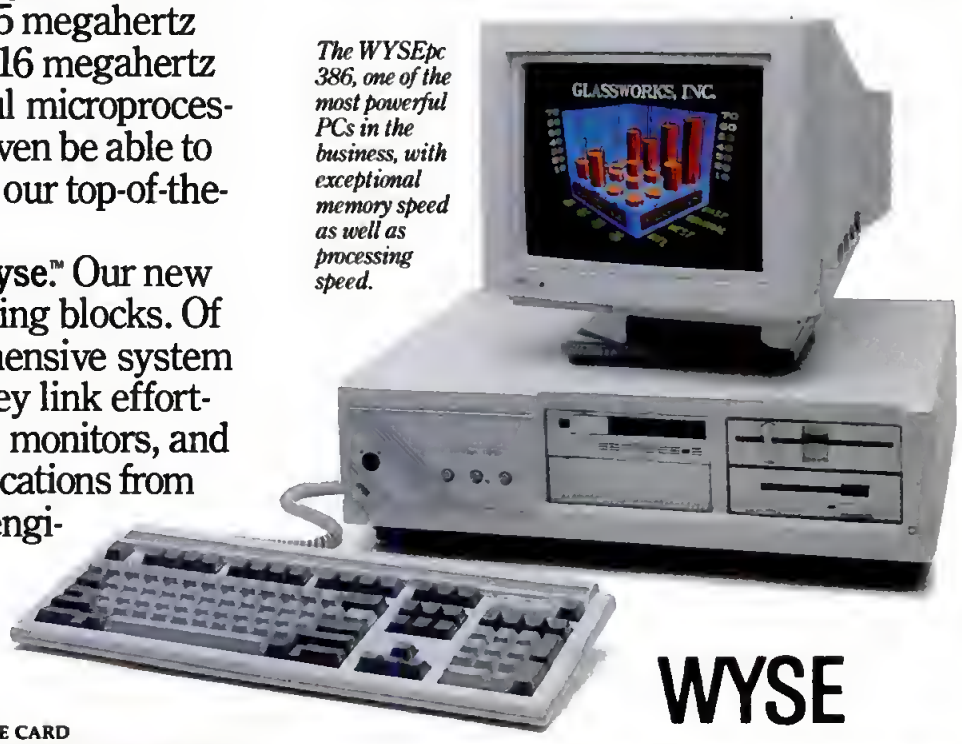


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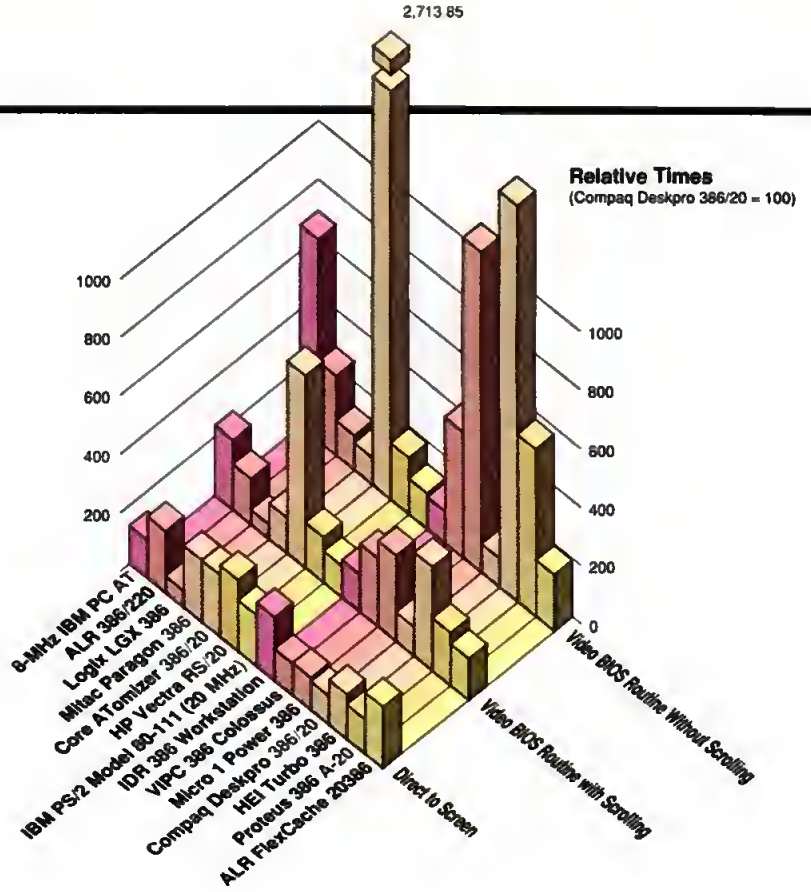
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Benchmark Tests: 20-MHz 80386-based PCs

Using an AT-class hard disk in a 20-MHz 80386-based machine may seem criminal, but that is what IBM's PS/2 Model 80-111 and all but four of the 80386-based PCs tested here do. The PS/2 Model 80 and the ALR 386/220 largely make up for their relatively slow drives by using caching software. The slower the drive, the greater the inherent benefit in disk caching software—and these two machines, with their 30-millisecond drives, showed close to a 50 percent performance increase in our small-record DOS File Access test when the caching software was installed. Like the Compaq Deskpro 386/20, the ALR FlexCache 20386 uses caching software with an 18-millisecond drive but gains only a bit better than 40 percent. The upshot is that the DOS File Access results are close for all these machines, despite the performance of the underlying hard disk as timed in the BIOS Disk Seek test.

The exception to the rule is the HP Vectra RS/20, which starts with an 18-millisecond drive and uses caching software to quadruple its performance on our small-record DOS File Access test, giving it more than twice the speed of any other drive tested. One of the reasons for the RS/20's dramatic increase in caching performance is its optional scheme for caching written data. Instead of being written to disk immediately, data is held in cache memory until the next disk rotation brings the correct sector to the read/write head. This feature affects large record writes negatively, so we disabled it for our large-record DOS File Access test and got results similar to those obtained from the other machines with caching.



Performance Times
(Times given in seconds)

	Direct to Screen	Video BIOS Routine with Scrolling	Video BIOS Routine Without Scrolling
8-MHz IBM PC AT	4.90	7.60	4.50
ALR 386/220	7.91	5.00	1.76
Logix LGX 386	2.15	1.64	0.77
Mitac Paragon 386	7.91	3.95	0.61
Core ATomizer 386/20*	7.86	21.03	17.64
HP Vectra RS/20	9.06	5.06	1.26
IBM PS/2 Model 80-111 (20 MHz)	6.50	3.50	0.80
IDR 386 Workstation	8.07	4.12	0.72
VIPC 386 Colossus	4.07	7.52	2.80
Micro 1 Power 386	4.18	9.45	7.14
Compaq Deskpro 386/20	3.70	3.20	0.65
HEI Turbo 386	5.77	11.37	8.84
Proteus 386 A-20	4.45	5.77	3.73
ALR FlexCache 20386	7.86	4.56	1.26

* The tested unit was an unenhanced Core ATomizer, without the RELOCATE program discussed in the text

The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times, and the result shown is the total of the 1,000 trials.

The **VIDEO BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

The **Video BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 60 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times, and the result shown is the total of the ten trials.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

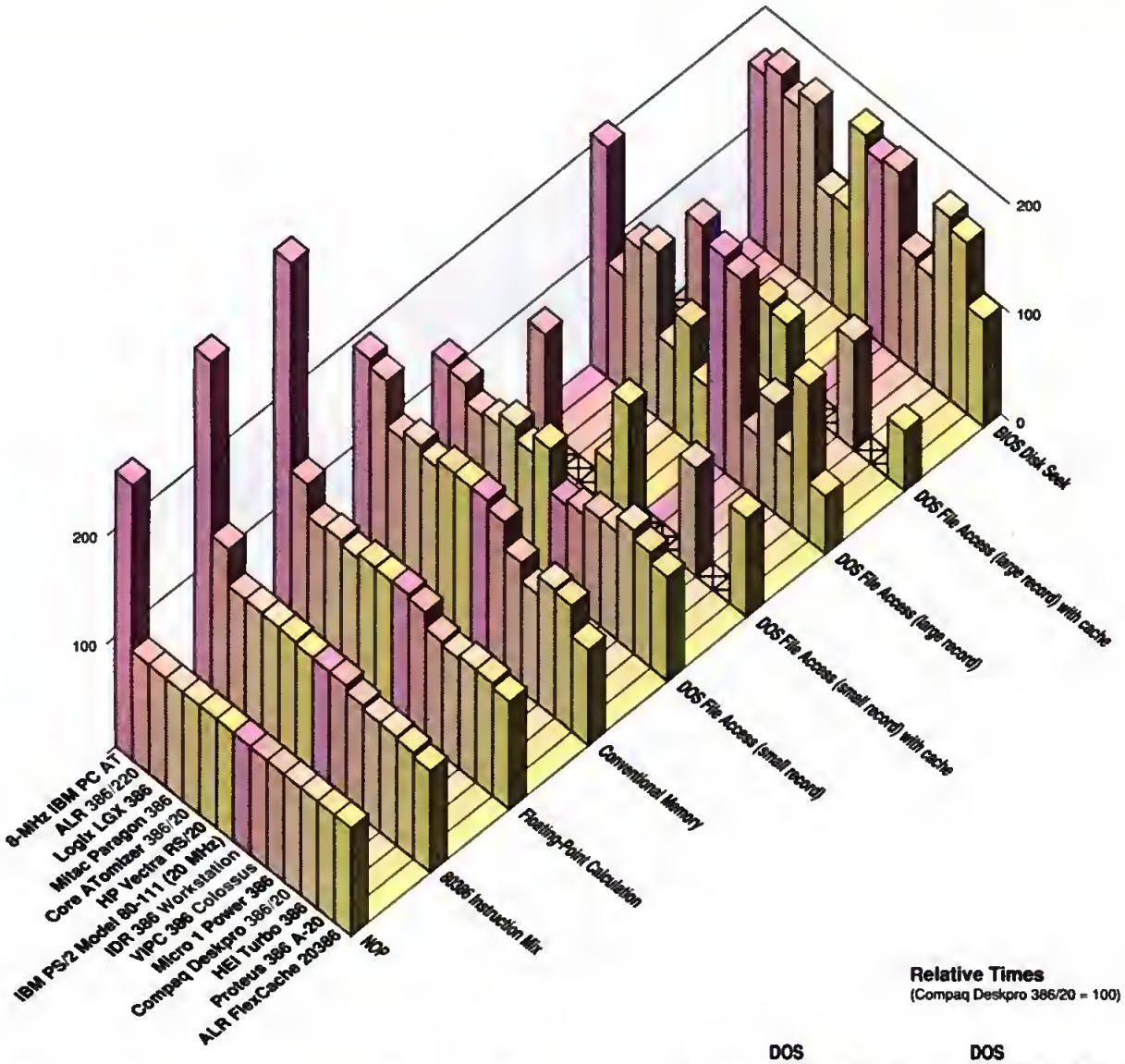
The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 Instruction Mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS File Access** benchmark test measures the throughput rate of the disk being tested. In this case, throughput times are measured in terms of how long the disk takes to perform common DOS file-management functions. Five tasks—file creation, sequential file write, sequential file read, random file write, and random file read—are timed and the results summed. The test is carried out for two different types of files—small-record files and large-record files—that are used by common PC applications. Files created using small records are typically used by database management programs, and large records are typically used for word processing and spreadsheet files. Loading a DOS program is also simulated by the large-record test.

The **BIOS Disk Seek** benchmark test measures the time it takes to do a random seek using the disk's ROM BIOS. The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks. The average result is shown in milliseconds.



Relative Times
(Compaq Deskpro 386/20 = 100)

Performance Times
(Times given in seconds except where noted)

	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	DOS File Access (small record)	DOS File Access (small record) with cache	DOS File Access (large record)	DOS File Access (large record) with cache	BIOS Disk Seek (milliseconds)
8-MHz IBM PC AT	4.17	8.96	35.60	0.77	72.63	N/A	19.74	N/A	29.20
ALR 386/220	1.65	4.29	15.59	0.74	70.37	37.79	9.79	8.75	31.54
Logix LGX 386	1.65	3.29	12.52	0.57	60.25	N/A	13.29	N/A	28.35
Mitac Paragon 386	1.65	3.29	12.80	0.60	62.28	N/A	14.22	N/A	31.12
Core ATomizer 386/20	1.65	3.27	12.35	0.57	68.82	N/A	7.15	N/A	17.86
HP Vectra RS/20	1.65	3.26	12.79	0.60	62.17	14.18§	10.22	6.62‖	18.22
IBM PS/2 Model 80-111 (20 MHz)	1.65	3.20	12.70	0.60	71.56	36.79	6.20	6.11	32.70
IDR 386 Workstation	1.65	3.19	12.74	0.60	49.34	N/A	18.48	N/A	30.32
VIPC 386 Colossus	1.65	3.19	12.36	0.57	51.78	N/A	17.72	N/A	30.96
Micro 1 Power 386	1.65	3.02	10.82	0.47	56.59	N/A	5.46	N/A	19.08
Compaq Deskpro 386/20	1.65	2.91	10.50	0.40	56.78	34.14	9.34	9.40	18.10
HEI Turbo 386	1.65	2.91	10.83	0.47	64.82	N/A	6.16	N/A	30.39
Proteus 386 A-20	1.65	2.86	10.82	0.46	60.02	N/A	13.34	N/A	28.49
ALR FlexCache 20386	1.65	2.74	10.38	0.35	54.27	31.25	5.02	5.15	17.92

N/A—Not applicable: no disk caching software is included with the system.
§Tested with write caching option H enabled.
‖Tested with write caching option H disabled.

LOGIX MICROCOMPUTER

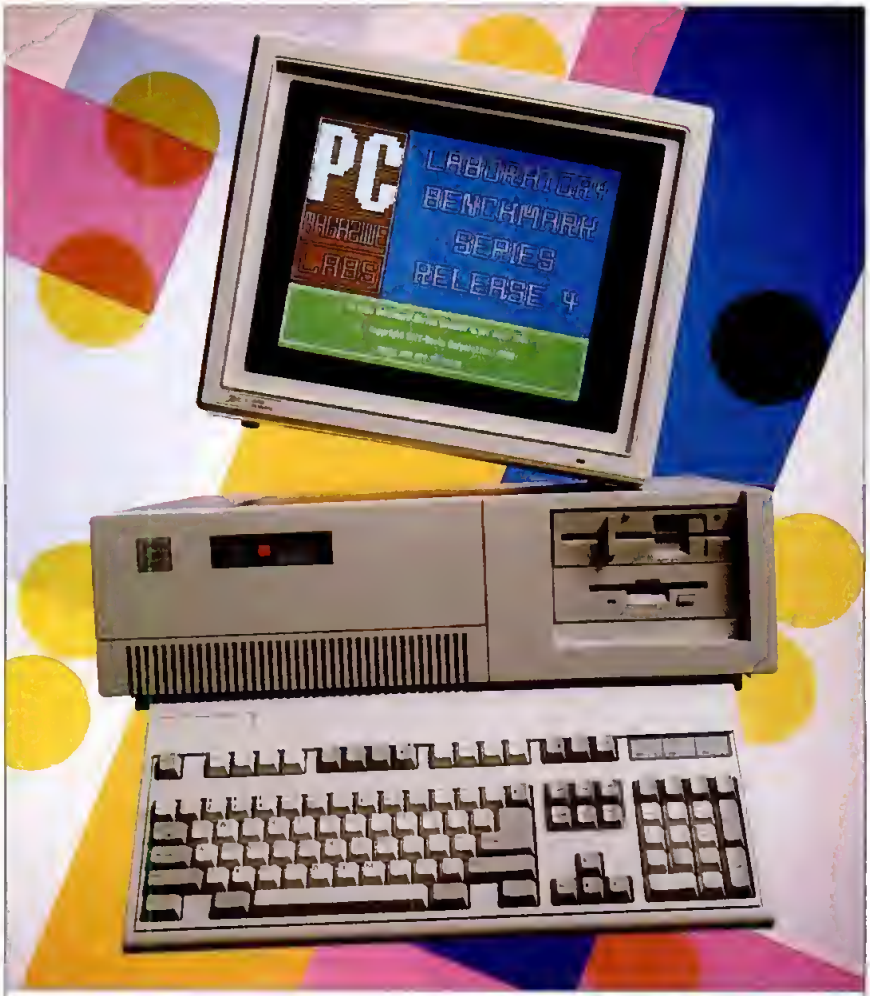
Logix LGX 386

There is the feeling of a stripped-down speedster about the Logix LGX 386. The machine gives the impression of being built for computational torque, not elegant solutions or finely finished cabinetry. It isn't among the very fastest machines and it doesn't use their speed gimmicks—like static-column RAM—but it is in the front rank of the 20-MHz machines we tested.

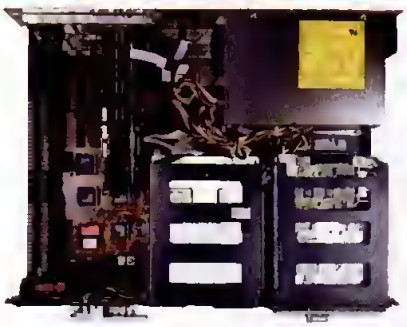
On the outside the LGX is a plain-vanilla AT. The case is the size, shape, and coloring of an AT, with a keyboard keylock, reset button, and indicator lights for power, hard disk, and "turbo" mode on the left, and two half-height drive bays poking through the front panel on the right.

Inside, the feeling of leanness is fostered by a motherboard with a very low chip count: a Chips and Technologies VLSI CHIPSet furnishes the circuitry to support the 80386 processor. System memory is mounted on two proprietary 32-bit expansion cards rather than on the motherboard. Even system I/O is carried on an add-in card rather than attached to the motherboard. A short card adds serial and parallel ports, with a second serial port installed in a knockout in the back panel of the computer.

Slots for the eight full-sized AT expansion cards are arranged on the left. Two are dedicated to 32-bit memory. Of the remaining six, four are 16-bit AT slots and two are 8-bit PC/XT slots. Three of the slots in the test machine were filled with video and communications cards and a National Computer Ltd. combined floppy/hard disk controller; hence, with the LGX 386's configuration, eight slots does not exactly mean wide open spaces.



The Logix LGX 386, pictured here with the beautiful Zenith flat tension mask monitor, came up a winner in video display benchmark tests. The system includes 2MB RAM standard and two expansion slots for 32-bit memory additions.



The system RAM consists of 100-nanosecond DRAM chips arranged in an interleaved access pattern to help keep the system working at zero wait states. RAM is expandable to 16MB in the LGX 386, and Logix is now offering a single memory board based on the more convenient SIMM (single in-line memory module)

PC MAGAZINE FACT FILE

Logix LGX 386
Logix Microcomputer
131 Naugatuck Ave.
Milford, CT 06460
(203) 877-6991

List Price: With 2MB RAM, 1.2MB floppy disk drive, $2,495; 72MB hard disk, $849; 2MB RAM expansion, $627; 80387 math coprocessor, $735; Zenith flat tension mask VGA monitor and card, $1,177; 3½-inch floppy disk drive, $149; Mouse Systems mouse, $109; DOS 3.3, $95.

In Short: Though lacking in the kind of technological innovation that makes some of its competitors stand out, the LGX 386 is priced right and is a strong performer, especially in video speed.

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technology to simplify the process of enhancing the machine.

Stuck to one side of the 200-watt power supply is a battery holder for four AA cells. The LGX 386 takes particular interest in getting an uninterrupted flow of power to the system clock and CMOS configuration RAM. Rather than using the lithium battery made standard by the AT, the LGX contains a rechargeable nickel cadmium battery and charging circuit, and it backs that up, lest anything go wrong, with the provision for AA power.

> The LGX 386 is the only 20-MHz machine tested here that comes even close to the video performance of the Compaq Deskpro 386/20, the fastest video performer on the market.

The LGX is lean in one other area: documentation. A few stapled sheets constitute a system setup guide. A few more, labeled "PAT386 User's Manual," give minimal information on the motherboard, jumper settings, and using the setup program.

The evaluation system, priced at $6,305, came with 2MB RAM and an 80387 math coprocessor installed. It also contained a 72MB Micropolis hard disk and two Toshiba floppy disk drives: a 1.2MB 5¼-inch and a 1.44MB 3½-inch. A Paradise VGA was coupled to a lush Zenith flat tension mask (FTM) monitor. The flat tension mask creates a screen image so flat that, like the carefully ground grill of a Rolls-Royce, it creates the optical illusion of being concave. The deep, saturated colors and extremely high definition spoil a user for any other monitor. The Maxi-Switch IBM Enhanced-style keyboard supplied with the system, on the other hand, is hardly the Rolls-Royce of input devices.

Virtually the only speed-up gimmick that the LGX 386 uses is the common one of relocating the ROM BIOS and video BIOS into shadow RAM—that is, copying the code from slower ROM into the fast 32-bit RAM in the address space used by the system above the 640K DOS limit.

This forms at least part of the explanation for the LGX 386's extremely quick execution of the three PC Labs video benchmark tests. Managing the video display can be a tremendous bottleneck for computers that are otherwise very fast. The LGX 386 is the only 20-MHz machine tested here that comes even close to the overall video performance of the Compaq Deskpro 386/20, the fastest video performer on the market.

The LGX 386, which lists for $2,495, is an off-the-shelf machine, put together from stock parts, but it is intelligently constructed, with the engineering effort going into the right places: the places that make it fast and useful.—**David DeJean**

MICRO 1

Micro 1 Power 386

When is a 20-MHz 386 not just another 20-MHz 386? Micro 1 announced its Power 386 last November, stressing that the machine was "90 percent domestic content." Well, if it'll make the box stand out a little, wrapping it in a flag couldn't hurt.

Under the bunting, though, is a machine that looks like a lot of other 386s, and they're all dead ringers for the good old IBM PC AT. The Power 386 is AT-high, AT-wide, AT-deep, with keylock, reset switch, and indicator lights to the left, three half-height drive bays open through the front panel, and a full-sized bay within.

Inside, things are almost as familiar: a 200-watt Astec power supply at right rear; eight full-sized AT slots on the left (two 8-bit and six 16-bit); 1MB of dynamic RAM on the Mylex-386 motherboard (which also includes 64K of static RAM cache); sockets for both 80287 and 80387 math coprocessors; and an AMI BIOS. All the onboard RAM and ROM is configured 32 bits wide to take maximum advantage of the 80386's addressing capabilities.

As the benchmark tests show, the performance of this all-American is pretty much Joe Average for the machines reviewed here—but it's in some pretty fast company, and running two to three times as fast as an 8-MHz PC AT isn't bad. Unfortunately, the Power 386 is at its slowest where it can hurt the most: in its handling of video. It was the third-slowest machine on the video benchmark tests; only the HEI Turbo 386 and the Core ATomizer 386/20 were slower. No computer can work faster than it can display the results.

BASE-PRICE BARGAIN Even its $3,495 base price puts the Power 386 dead in the middle of the machines tested, but Micro 1's honesty reveals a bargain. That price includes a 1.2MB floppy disk, a 49MB hard disk, software (DOS 3.3, *Windows/386*, software to support the LIM expanded memory specification, and a disk optimizer package), plus a monochrome monitor and video card—all the things necessary to a running system but seldom included in the base price of the Power 386's allegedly less-expensive competition.

Three of the test system's eight slots were filled by video, disk drive, and I/O controllers. A Suntek I/O Extension-A communications card carried serial and parallel connectors on its retaining bracket, and a ribbon cable ran to a second serial connector in a back-panel knockout. The drive controller was a Western Digital WD1007A, which controls both hard and floppy disk devices. The 1.2MB floppy

FACT FILE

Micro 1 Power 386
Micro 1
557 Howard St.
San Francisco, CA 94105
(415) 974-5439
List Price: With 1MB RAM, 1.2MB floppy disk drive, 49MB hard disk, monochrome monitor and video card, $3,495; VGA monitor and card, $715; NEC MultiSync II monitor and card, $865; 82MB hard disk, $475; 88MB ESDI hard disk, $990; 155MB ESDI hard disk, $1,430; 80387 coprocessor, $795; 3MB RAM expansion, $1,200; 3½-inch floppy disk drive, $159.
In Short: The Micro 1 Power 386 is a moderately priced, AT-style 20-MHz machine that includes more features in its base price than do most of its competitors. The machine's important limitation is its lack of 32-bit expansion capability.
CIRCLE 665 ON READER SERVICE CARD

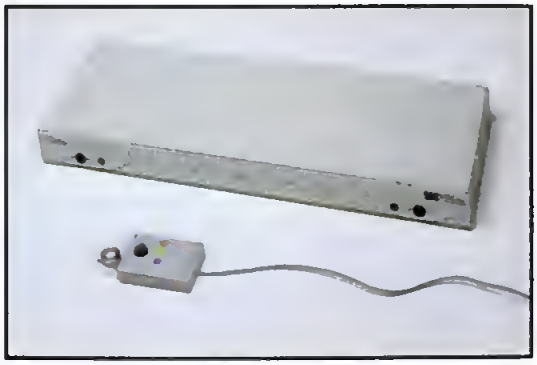
Digitizers

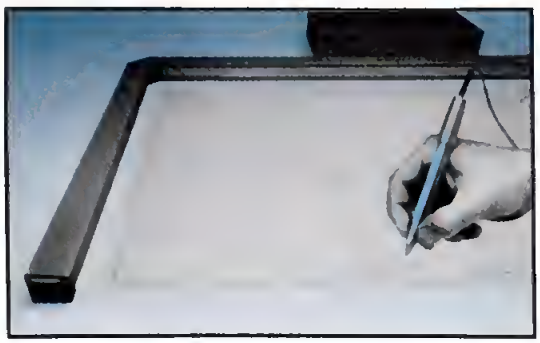
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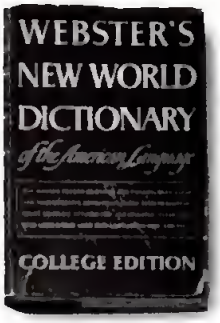
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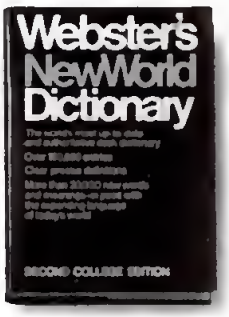
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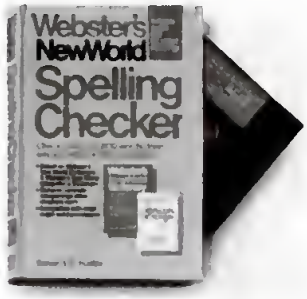
1738, Webster's
Blue-Backed Speller



1951, Webster's
New World Dictionary



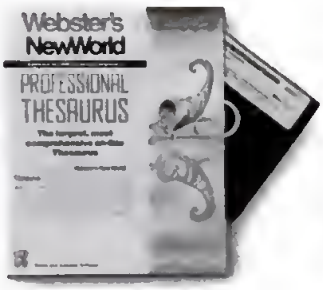
1970, Webster's New
World Dictionary, Second Edition



July 1985, Webster's
New World Spelling Checker



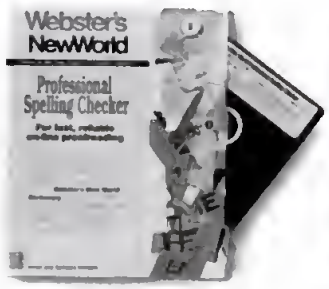
December 1987,
Webster's New World Combo–
Speller/Thesaurus



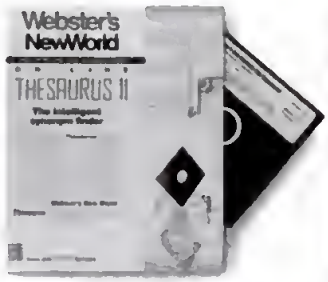
January 1988,
Webster's New World Professional
Thesaurus



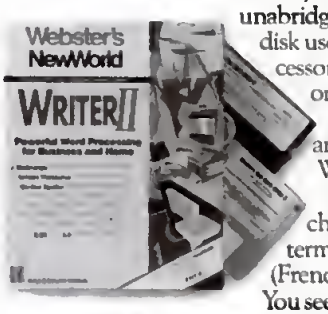
January 1988,
Webster's New World
Outliner +



April 1988, Webster's
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Spelling Checker



April 1988,
Webster's New World
Thesaurus II



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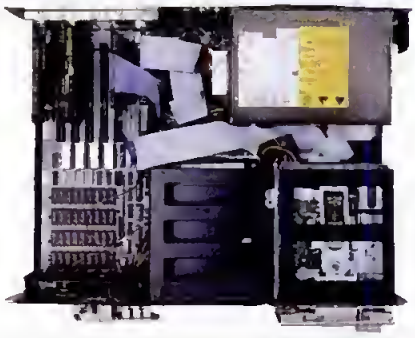
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CIRCLE 158 ON READER SERVICE CARD



The Micro 1 Power 386 has no 32-bit expansion slots, but its $3,495 price (which includes a 49MB hard disk, monochrome monitor, Microsoft Windows/386, *and other software) makes it one of the 20-MHz 386 bargains.*



disk drive, from Teac, had an annoying personality quirk: the drive wouldn't eject the disk when the door was opened, but instead forced the user to go in after it. Tweezers would have helped. Also on the negative side, the keyboard supplied with the Power 386—a Key Tronic 101-key unit—was among the least satisfactory tested. The documentation was adequate, and it included a fairly thorough section on the motherboard and its settings.

The hard disk that came with the Power 386 was a half-height, 49MB unit made by Magnetic Peripherals, a division of Control Data. Its 39-millisecond access time brought programs to the screen with unexpected speed.

In addition, the system tested for this review was dressed up with a NEC MultiSync II monitor and a Paradise VGA Plus controller, a Toshiba 3½-inch floppy disk drive, and an Intel 80387 math coprocessor. Those touches brought the price of the system as tested to $7,495.

One other thing will inevitably add to the cost of the Power 386: extra memory. A megabyte of RAM is not a lot of elbow room for a 386 machine to work in. Upgrading means pulling all the 256K by 1 memory chips on the motherboard and replacing them with denser chips. There's no easy way to add fast 32-bit memory—no 32-bit expansion slots, no SIMMs (single in-line memory modules) on the motherboard.

With those physical limitations on the negative side, and Micro 1's effort to offer a complete system very much on the positive side, the Power 386 emerges, on balance, as a fast, powerful 386 with limitations that are partly due to the off-the-shelf nature of the machine. Whether it's a 386 machine or Frankenstein's monster, if you assemble it from unrelated parts, it's tough to give it a winning personality.

—David DeJean

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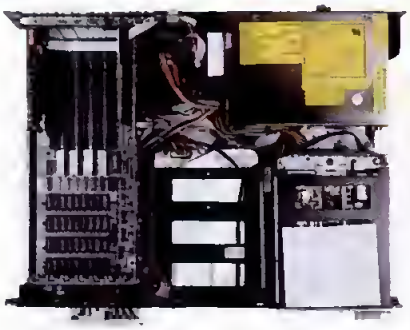
Proteus 386 A-20

The Proteus 386 A-20 is yet another machine that pales only when compared with today's most exotic competition. Jockeying its 80386 microprocessor at 20 MHz with a 64K static-RAM cache, it crunches through calculations nearly twice as fast as the now-discontinued IBM PC AT it resembles. In fact, when it comes to number crunching, this model ties with the Micro 1 Power 386 for third place among all those reviewed here.

The $3,190 computer even casts a backward eye to compatibility with whatever speed-dependent programs still exist by allowing a 6-MHz slow-motion mode that also disables the cache.



Like four of the other machines reviewed here, the $3,190 Proteus 386 A-20 lacks 32-bit expansion slots. But the machine compensates by accommodating 4MB of 32-bit RAM in the motherboard—a feature that makes it stand out among other 16-bit, AT-like 386 machines.



Exactly matching the AT design school in mechanicals (but not aesthetics), the American-made Proteus 386 A-20 boasts slightly improved drive accommodations. All three 5¼-inch half-height drive bays on the right of the machine have front-panel access, as does the full-height hard disk bay. The plastic panels used for blanking off unused bays are secured by Phillips screws rather than the flimsy tabs so many machines use.

The rear panel features the expected row of eight retaining brackets, the keyboard connector, three cutouts for chassis-mounting 25-pin D-shell connectors and the power supply. Both power input and switched power-output connectors are available, as is a recessed slide switch for selecting 115- or 230-volt operation of the 200-watt power supply.

The system board inside the Proteus 386 A-20 is manufactured by AMI and is an exact AT compatible, right down to the slot types. Two 8-bit and six 16-bit slots highlight the system board, which has no provision for 32-bit expansion.

Part of the need for memory expansion is ameliorated by the memory accommodations. Four banks of nine sockets each allow installation of a variety of RAM capacities, from 256K in one bank of 256-kilobit chips, to 4MB in four banks of 1-megabit chips. Although standard equipment includes only 1MB, the evaluation machine was equipped with the maximum 4MB memory in the guise of 100-nanosecond chips. A fully documented bank of DIP switches is used for setting memory type and other system options.

As with the AT, the Proteus 386 A-20 contains a socket for an 80287 coprocessor but makes no specific provision for an 80387. Proteus will supply an 80387 coprocessor on a special adapter board if you require maximal mathematical performance.

PC MAGAZINE FACT FILE

Proteus 386 A-20
Proteus Technology Corp.
Airport 17 Ctr.
377 Route 17
Hasbrouck Heights, NJ 07604
(201) 288-8629
List Price: With 1MB RAM, 1.2MB floppy disk drive, $3,190; 44MB hard disk, $595; 72MB hard disk, $895; 140MB hard disk, $2,095; EGA monitor and card, $594; VGA monitor and card, $840; 4MB RAM expansion on motherboard, $1,495; 3½-inch floppy disk drive, $129; 80387 coprocessor, $845.
In Short: An AT-style middle-of-the-road performer from a company that has the ability to custom-configure machines in almost any permutation of memory and mass storage.
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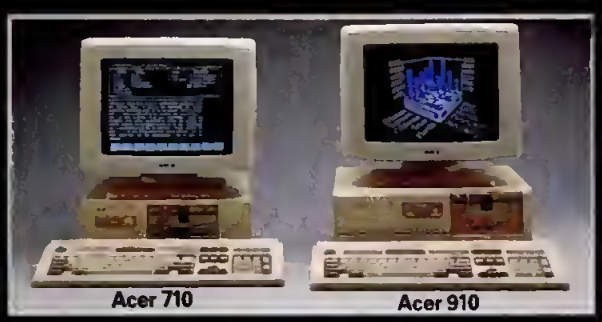
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CIRCLE 746 ON READER SERVICE CARD

HEAVYWEIGHT The Proteus chassis rates as a heavyweight, made from thicker-than-usual steel. Most interior wiring is adequately dressed except for the hard-disk-activity LED indicator, the leads of which were Scotch-taped into place. The 6.8-volt Tadiran lithium battery used for powering the system-board time-of-day clock and CMOS configuration memory was attached to the power supply and Scotch-taped into place, perhaps for shipping. Although the Proteus documentation states that this chassis has an FCC Class B rating, the sticker on the rear panel indicated only Class A certification.

The four BIOS chips are boldly labeled Proteus, but electronically they reveal an AMI copyright. This BIOS incorporates the system setup and diagnostic routines, which can be accessed through a keystroke as the machine boots up.

Proteus practically custom-builds its computers to the purchaser's specifications, which means that just about anything can to be found in its expansion slots and drive bays. Minimum specifications call for a 1.2MB 5¼-inch floppy disk drive, and three ports are implemented on a single short expansion card in an 8-bit slot. COM1 uses an XT-style male 25-pin D-shell connector; COM2, an AT-style male 9-pin D-shell; and LPT1, a female 25-pin D-shell.

The combined hard/floppy disk controller in the evaluation machine was a Western Digital WD1003, which is capable of operating two floppies and two ST-506 interfaced hard disks. Mass storage options in the evaluation machine included an optional Priam ID-40 42.5MB (formatted) hard disk with a 33-millisecond average access time and a 1.44MB 3½-inch floppy disk drive.

Proteus also included an Everex EGA adapter and a Mitsubishi AUM-1371A MultiSync-style monitor. It proved to be a good pairing. The EGA board worked well and quickly. The monitor was bright and sharp (with a 0.31mm dot pitch) and looked stylish on its built-in tilt-swivel stand. It includes both TTL and analog inputs with enough bandwidth to allow you to upgrade to VGA. The total price of the configured evaluation system was $6,003.

The Proteus keyboard follows the IBM Enhanced 101-key layout. While its rubber-dome technology gives a good tactile feel, the keycaps have a shaky looseness that makes the keyboard seem cheap, although it was easy to type on.

PC MAGAZINE EDITOR'S CHOICE

• HP Vectra RS/20

All the machines we looked at were extremely fast and powerful, so the best are singled out for innovation, quality, and value. The HP Vectra RS/20 is a breakthrough for Hewlett-Packard. With its incredibly fast drives, generous expansion space, and rock-solid construction, the RS/20 stands a step above its competitors. Of course, high quality often carries a high price tag, and the $9,995 (with 150MB hard disk) RS/20 follows the rule. Nevertheless, for businesses and corporate buyers who can foot the bill, the RS/20 is a wise choice.

Three machines deserve honorable mention. The ALR FlexCache 20386 will make a name for itself as a heavy-duty file server. Faster than the Compaq Deskpro 386/20 and priced $2,500 to $3,000 less for a similar configuration, the FlexCache is destined for success.

For individual users who don't need all the mass-storage real estate of a file server, the IDR 386 Workstation and the Mitac Paragon 386 are the most powerful small-footprint machines yet. They point toward a future where the kind of computing power most of us are still dreaming about is packed into a small, inconspicuous box sitting on the corner of a desk.

The Vectra RS/20 is our first 20-MHz Editor's Choice, and it joins our previous Editor's Choices in the 16-MHz 80386 category: the Compaq Deskpro 386, the IBM Personal System/2 Model 80, the soon-to-be-redesigned PC's Limited 386-16, and the NCR PC916.

The Proteus 386 A-20 is a good work platform for anyone who does not need more than 4MB of fast RAM. It will give you the power and flexibility of the 80386 in a completely AT-compatible package—one that just about makes the 80286-based AT obsolete.—**Winn L. Rosch**

VIPC COMPUTERS

VIPC 386 Colossus

In the days before video, the Colossus of Rhodes was one of the Seven Wonders of the World. When I pulled the cover off the $1,999 VIPC 386 Colossus, I was reminded of another great wonder: the Leaning Tower of Pisa. Everything about the machine seemed to be askew. Even though the case may have taken a thumping in shipment, this modern-day Colossus evidently lacked the craftsmanship of the one of yesteryear.

In an effort to display the potential power of the machine, the factory stuffed our evaluation unit's AT-clone chassis with every accessory imaginable, not just filling every slot but filling some double with sandwich boards and daughterboards—and probably granddaughters, nieces, and cousins. It was a lesson on how not to expand your computer, with squashed cards squirming under the pressure of others, curving gently in a way that rigid glass epoxy was never meant to.

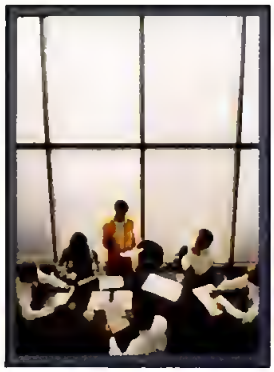
The Colossus is an 80386-equipped computer in an AT's clothing. A true four-speed, it's capable of operating at 6, 8, 10, or 20 MHz. Per IBM's last-generation fashion, the chassis offers one full-height internal drive bay suitable for a hard disk and three half-heights on the right, the top two of which can be accessed through the front panel.

FAMILIAR STYLING Inside and outside, the chassis styling is pure AT, down to the control panel located on the upper-left-hand side of the front panel, which, of course, features a cylindrical chassis and keyboard lock, as well as power- and drive-activity indicators. The rear follows the typical AT scheme with the expansion slots on the left, a 200-watt power supply (with power-in and switched power-output connectors as well as a slide switch for selecting 115- or 230-volt operation) on the


You can't buy a faster 286
computer for the price.
In fact, you can't buy a faster
286 computer at any price.



Because.



The handsome piece of high-tech wizardry you've just been admiring (on the previous two pages) is the new Dell System 220.

The first 286 computer running at 20 MHz. You read it correctly. 20 MHz.

Which means it's as fast as most 386 computers, running MS® OS/2 and MS-DOS® at blistering speed. All from a tiny little corner of your desk.

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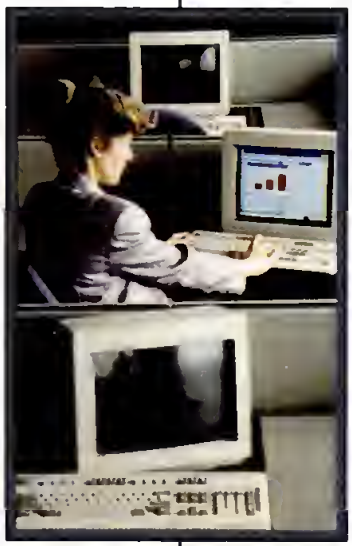
Which might lead you, quite reasonably, to wonder:

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The short answer is that you buy direct from us, the manufacturer.

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–Al Poor, Editor's Choice, PC Magazine



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–Eric Knorr, PC World

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Our attitude towards service is perhaps best summed up by a phrase we hear around here, delivered in a no-nonsense tone by our Chairman, Michael Dell:

"Fix it," he says. "Or give them their money back."

"If your desire for speed is inexhaustible, [this is] the machine for you...it's reassuring when a computer completes some operations even before your fingers leave the keyboard."

–Harry Miller, PC World

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THE NEW SYSTEM 310.

The top of the line. It's the highest performance 80386 computer available, faster than the IBM† PS/2† Model 80 and the Compaq† 386/20. It runs at 20 MHz, with the latest 32-bit architecture for complete MS® OS/2 compatibility and maximum performance. Since it also has Intel's† Advanced 82385 Cache Memory Controller, and high performance disk drives, the System 310 is ideal for intensive database management, complex research and development, CAD/CAM, and desktop publishing. As a network file server the system offers an unbeatable combination of price and performance.

Standard Features:

- Intel† 80386 microprocessor running at 20 MHz.
- 1 MB of 80 ns 32-bit RAM expandable to 16 MB without using an expansion slot.
- Advanced Intel 82385 Cache Memory Controller with 32 KB of high speed static RAM.
- Socket for 20 MHz 80387 coprocessor.
- 5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
- Dual diskette and hard disk drive controller.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- 200-watt power supply.
- Real-time clock.
- 8 expansion slots (6 available with hard disk drive controller and video adapter installed).
- Dell System Analyzer.
- MS-DOS® and MS OS/2 compatible.
- Security lock with locking chassis.
- 12 month on-site service contract (Available on complete systems).

Options:

- 1 MB RAM upgrade kit.
- 20 MHz Intel 80387 math coprocessor.
- 2 MB or 8 MB memory expansion boards.

SYSTEM 310	With Monitor and Adapter		
Hard Disk Drives	VGA Mono	VGA Color	VGA Color Plus
40 MB-28 ms	$3,799	$3,999	$4,099
90 MB-18 ms ESDI	$4,599	$4,799	$4,899
150 MB-18 ms ESDI	$5,099	$5,299	$5,399
322 MB-18 ms ESDI	$7,099	$7,299	$7,399



THE NEW SYSTEM 220.

As fast as most 386 computers, at less than half the price—more power for the money than any other system. An 80286 system that runs at 20 MHz, with less than one wait state. Completely compatible for both MS-DOS and MS OS/2 applications (it runs OS/2 faster than IBM PS/2 Model 80), and with a remarkably small footprint, the System 220 is the ideal executive workstation for database management, business, or sophisticated connectivity applications. The system uses page-mode interleaved memory; the page-mode RAM operates at less than one wait state, and inter-leaving results in a performance increase of about 15 percent.

Standard Features:

- 80286 microprocessor running at 20 MHz.
- 1 MB of RAM expandable to 16 MB (8 MB on system board).
- Integrated diskette and VGA video controller on system board.
- One 3.5" 1.44 MB diskette drive.
- Integrated high performance hard disk interface on system board.
- Enhanced 101-key keyboard.
- 1 parallel and 2 serial ports.
- LIM 4.0 support for memory over 1 MB.
- Real-time clock.
- Three full-sized AT† compatible expansion slots.
- Socket for 80287 coprocessor.
- Dell System Analyzer.
- MS-DOS and MS OS/2 compatible.
- Security lock with locking chassis.
- 12 month on-site service contract (Available on complete systems).

Options:

- 3.5" 1.44 MB diskette drive.
- Intel 80287 coprocessor.
- 1 MB RAM upgrade kits.

SYSTEM 220	With Monitor		
	VGA Mono	VGA Color	VGA Color Plus
One Diskette Drive	$1,799	$1,999	$2,099
40 MB-29 ms Hard Disk	$2,499	$2,699	$2,799
100 MB-29 ms Hard Disk	$3,399	$3,599	$3,699



THE NEW SYSTEM 200.

A great value in a full-featured AT compatible. An 80286 computer running at 12.5 MHz, this system is completely MS OS/2 compatible. It's ideal for general business applications, as well as software development, local area networks, CAD/CAM, and desktop publishing. The System 200 offers high speed drive options, industry standard compatible BIOS, and on-site service. At these low prices, the System 200 is the best value in the 80286 marketplace. As Executive Computing said of this computer's predecessor, "If faster processing speed and low cost are two key issues affecting your purchase decision, this machine might be the ideal choice for your office."

Standard Features:

Intel 80286 microprocessor running at 12.5 MHz.
640 KB of RAM, expandable to 16 MB (4.6 MB on system board.)
5.25" 1.2 MB or 3.5" 1.44 MB diskette drive.
Dual diskette and hard disk drive controller.
Enhanced 101-key keyboard.
1 parallel and 2 serial ports.
200-watt power supply.
Real-time clock.
6 expansion slots. (4 available with hard disk drive controller and video adapter installed).
Socket for 8 MHz 80287 coprocessor.
Dell System Analyzer.
MS-DOS & MS OS/2 compatible.
Security lock with locking chassis.
12-month on-site service contract (Available on complete systems).

Options:
512 KB RAM upgrade kit.
8 MHz Intel 80287 coprocessor.

SYSTEM 200	With Monitor and Adapter			
Hard Disk Drives	Mono	VGA Mono	VGA Color	VGA Color Plus
20 MB	$1,799	$1,999	$2,199	$2,299
40 MB-40 ms	$1,999	$2,199	$2,399	$2,499
40 MB-28 ms	$2,199	$2,399	$2,599	$2,699
90 MB-18 ms ESDI	$2,999	$3,199	$3,399	$3,499
150 MB 18 ms ESDI	$3,499	$3,699	$3,899	$3,999
322 MB 18 ms ESDI	$5,499	$5,699	$5,899	$5,999



THE NEW SYSTEM 100.

A full-featured, yet economical one-piece computer for office, school, or home. This system is fast, easy to use, and ready to run with Dell Enhanced MS-DOS 3.3, Microsoft® DOS Manager, and Microsoft Works software–more than a $400 value, included at no extra charge. Complete MS-DOS compatibility means you can run thousands of programs for business, personal finance, education, and entertainment. And the System 100 can grow, with the high quality options listed below. A price leader in 8088 technology, the System 100 boasts an innovative design that allows for more power, speed and convenience than most of its competitors.

Standard Features:

Intel 8088 microprocessor running at 9.54 MHz selectable to 4.77.
640 KB of RAM.
3.5" 720 KB diskette drive.
Diskette drive controller integrated on system board.
Integrated high-quality 84-key keyboard.
1 serial and 1 parallel port.
Two full-sized expansion slots available when video adapter is installed.
One half-sized expansion slot used for video adapter.
Socket for 8 MHz 8087 coprocessor.
Internal speaker with earphone jack and volume control.
Security Tie-Down bracket.
Dell Enhanced MS-DOS 3.3 Microsoft DOS Manager, Microsoft Works.

Options:
3.5" 720 KB diskette drive.
8 MHz Intel 8087.

SYSTEM 100	With Monitor and Adapter			
	Monochrome	CGA Color	VGA Mono	VGA Color
720 KB Diskette Drive	$799	$899	$999	$1,199
Two 720 KB Diskette Drives	$949	$1,049	$1,149	$1,349
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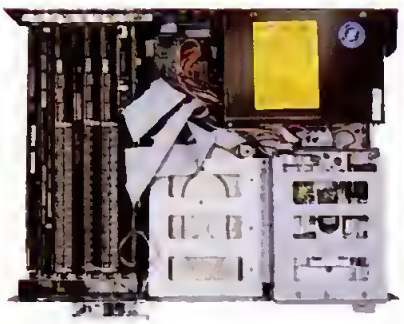
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CIRCLE 533 ON READER SERVICE CARD



The VIPC 386 Colossus received by PC Labs had $8,000 worth of options installed, elevating its very low base price of $1,999 to $9,999. Standard equipment includes 1MB of static-column RAM and one 32-bit expansion slot.



PC MAGAZINE FACT FILE

VIPC 386 Colossus
VIPC Computers
384 Jackson, #1
Hayward, CA 94544
(800) 222-5657
(415) 881-1772

List Price: With 1MB RAM, 1.2MB floppy disk drive, $1,999; NEC MultiSync monitor and card, $994; 80MB hard disk, $999; 80387 coprocessor, $749; 1.44MB 3½-inch floppy disk drive, $150; multifunction card with 3MB RAM, serial port, parallel port, $900.

In Short: The Colossus had the lowest base price of the machines in this roundup, but construction quality was less than what you should expect of such a high-end machine.

CIRCLE 982 ON READER SERVICE CARD

right, with the keyboard connector in the center. VIPC adds five blanked cutouts for D-shell port connectors: two for 9-pin and three for 25-pin.

Standard I/O accoutrements include two serial, two parallel, and one game port. EGA video is also included in the base price.

Although the internal layout of the Colossus is identical to that of most AT clones, its system board is not. Unlike that of most PCs, in which all of the essential circuitry is attached directly to the system board, the big essentials of the Colossus are elsewhere. Both the 20-MHz 80386 main processor and optional 20-MHz 80387 numeric coprocessor reside on a separate daughterboard of their own, plugged into the main board through a DIP chip connector.

Memory, too, is absent from the system board. All of the normal RAM of the Colossus is located on an expansion board—or on a piggybacked stack of two—in the machine's one proprietary 32-bit expansion slot. The base memory card includes 1MB RAM soldered down—in the guise of three dozen 256-kilobit, fast (80-nanosecond) static-column RAM chips—and an equal number of empty sockets awaiting a like set of chips.

An add-on memory daughterboard is attached by its component side to that side of this base memory card, allowing space for an additional 2MB (all socketed). All of the sockets in the system we reviewed were filled.

The system board, 80386 adapter card, and memory boards were all manufactured by Micronics. According to VIPC, the standard 1MB RAM is divided into 640K for DOS and 384K for shadowing the ROM BIOS. My calculations showed 128K of shadow memory; the rest, extended memory.

The balance of the 10MB-plus of extended memory in the evaluation system was filled in by 16-bit memory in the system's expansion slots.

Standard mass-storage equipment comprises only a 1.2MB 5¼-inch floppy disk

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886 pages*

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547 pages*

Genicom 3410
1032 pages*

Okidata 393
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■ 20-MHz 386s

drive operated by e Western Digital WD1003 combined hard/floppy disk controller. This controller can handle up to two floppy disks and two ST-506–interfaced hard disks. VIPC filled the full-height internal expansion bay with a Seagate ST-4096 hard disk, which has a capacity of 80MB and an average access time of about 31 milliseconds. The total price of the jam-packed evaluation unit

At $1,999 with ports and video, the VIPC 386 Colossus is priced below many bare 80386 system boards, but the total price of the jam-packed evaluation unit, which had an 80MB hard disk, was $9,999.

was $9,999.

The system BIOS ROM chips bore e Phoenix copyright legend, but the Colossus uses an Award Software keyboard PROM to match its Maxi-Switch keyboard, which is patterned after the IBM Enhanced keyboard. It has a quick but positive over-center feel. VIPC also supplied a NEC MultiSync and Quimax monochrome display along with the evaluation system.

An FCC Class A rating is claimed for the Colossus, but a certification sticker was notably absent from its rear panel. Indeed, there were enough variations between what the Colossus was supposed to be and what it really was to lead you to believe that this machine is built on a parts-as-available basis.

The bottom line is that the workmanship of the Colossus we saw was so-so and the specifications were perhaps less than rock solid. Nevertheless, it worked right out of the box and, at $1,999 with ports and video, the Colossus is priced below many bare 80386 system boards. You could throw out the chassis—and anything else you find doubtful—and still own a bargain.—**Winn L. Rosch** PC

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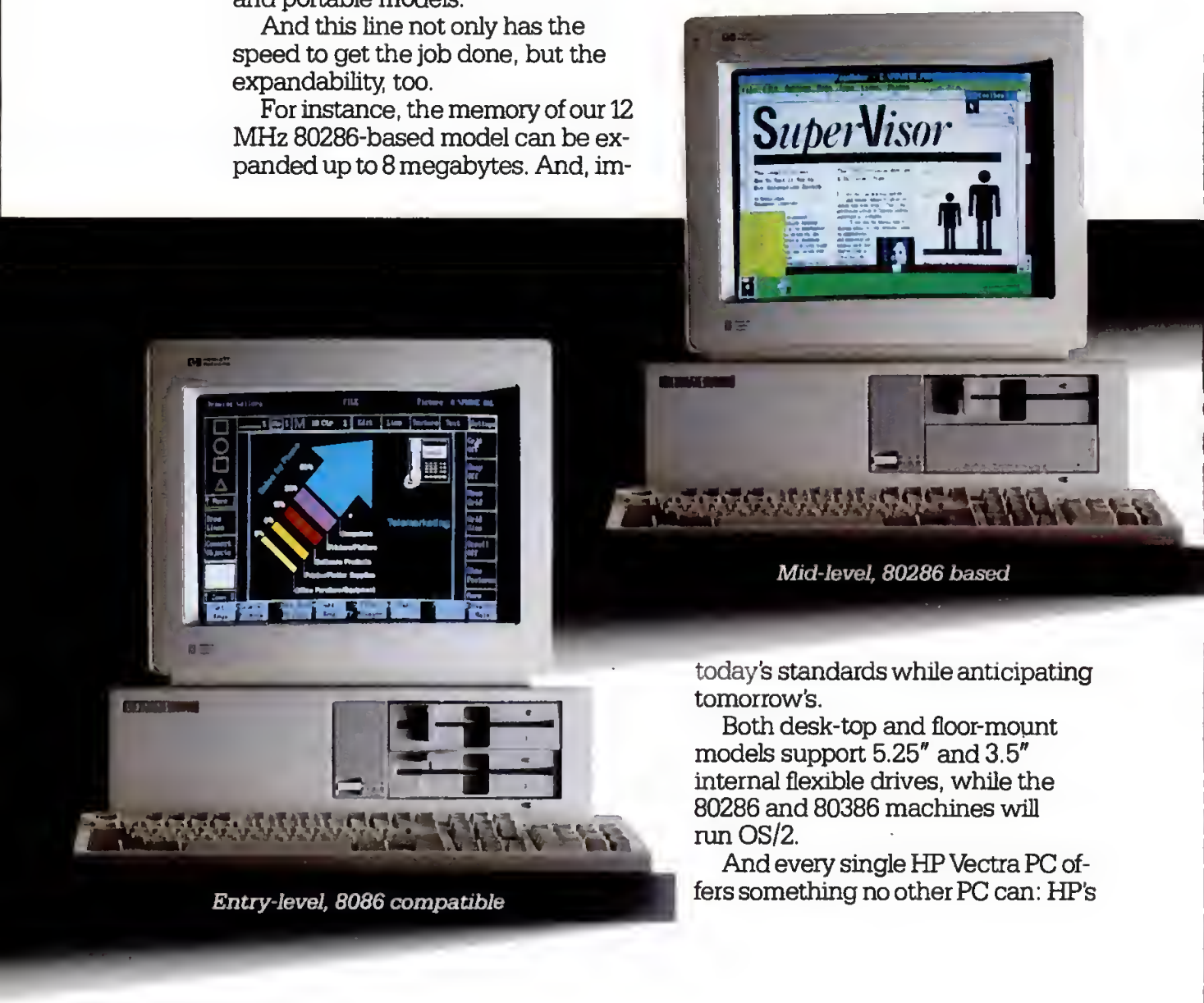
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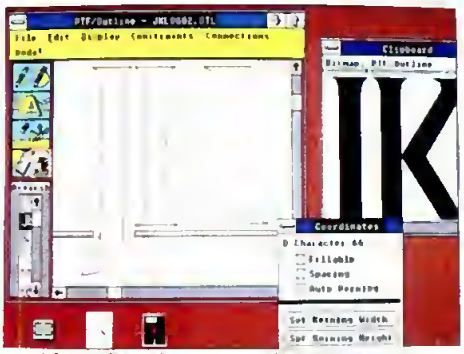
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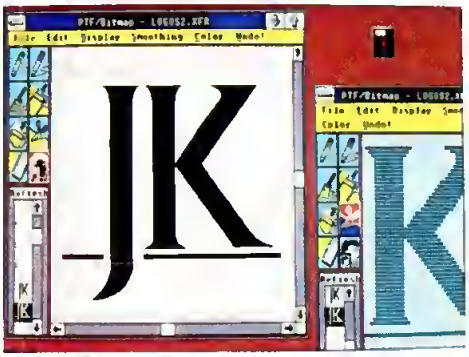
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BRUSHING UP ON TYPOGRAPHY

YOU SEE THEM EVERY DAY BUT don't often think about them—until you become the publisher. Behind every page of printed word stand the principles of the art of typography. Although unnoticed by the untrained eye, the discipline of typography can make or break the effectiveness of printed communications.

Until recently, most of us were sheltered from this arcane knowledge by the professional designers and typographers who translated our needs into the specifications required by typesetting equipment. In the traditional model, one typesetting system might have cost $100,000 and could well have been operated by two or three typesetters serving a hundred or more clients, including designers who in turn served hundreds of clients. Only those at the top of this hierarchy—closest to the equipment—knew the language of typography.

All this changed with the advent of laser printers and desktop publishing, when many of us catapulted from the strait-laced world of Courier and Elite into the exciting world of publication design and production. In this new model, the same person who writes the text can actually typeset the copy and lay out finished pages with graphics in place. In many respects it's a miracle that so many of us can grasp the wide range of typesetting capabilities that had been technologically reserved for a few professionals.

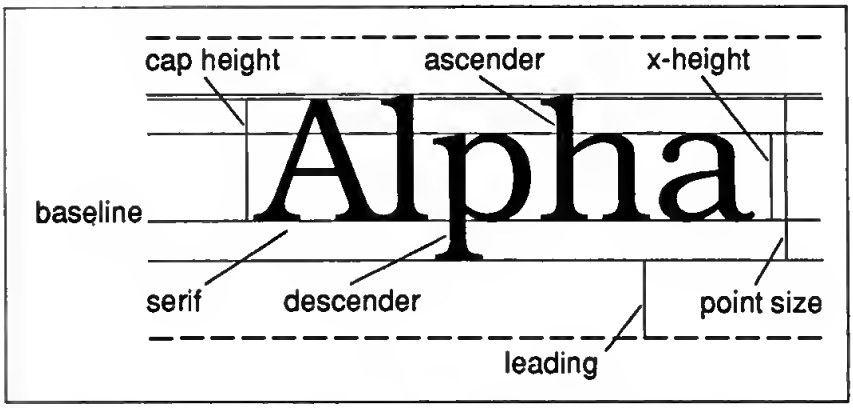
We are finding, however, that the design skills that supported page layouts in the past are not miraculously endowed on consumers in this expanded marketplace. Many novice desktop publishers don't realize that capable graphic designers often invest many hours in the study of typography. Fortunately, even without such a disciplined background, the conscientious

Stop, look, and think about the typefaces you use in your newsletters and reports. Achieving the "right look" in desktop publishing can be easy if you follow a few rules.

TYPE TERMS

A glossary to guide you to good-looking pages.

Alignment The way the text lines up on a page or in a column: align left (flush left, ragged right), align center, align right (flush right, ragged left), or justify (flush on both the left and right).
Ascender The portion of a lowercase character that rises above the x-height.
Baseline The invisible line defined by the lower edges of a row of letters, not including their descenders (the extensions of *g* and *j*, for instance).
Caps and small caps Two varieties of capital letters. Caps, sometimes referred to as "all caps," designates all uppercase letters. Small caps are the same size as the lowercase letters in the comparable font.
Descender The portion of a character that extends below the baseline.
Flush Refers to text that is lined up to form an even margin. See *alignment*.
Flush right, or right justified Text in which lines begin at varying distances from the left margin but end at the same point on the right margin—the opposite of *ragged right* or *left justified*.
Folio A page number, sometimes appearing with a chapter title or other text line.
Font One complete set of characters in the same typeface and size, including letters, punctuation, and symbols. For example, 12-point Times Roman is a different font from 12-point Times Italic, 14-point Times Roman, or 12-point Helvetica.
Greeking The conversion of text to symbolic bars or boxes that show the position of the text on the page or screen but not the alphanumeric characters.
H and J Short for *hyphenation and justification*.



Header One or more lines of "title" text appearing at the top of every page of a document.
Hyphenation The determination of where a word should break at the end of a line. On the computer, hyphenation can be achieved in several ways: some programs let you manually insert "discretionary hyphens" (hyphens that are visible only when they fall at the end of a line); some insert hyphens automatically based on an internal "dictionary" of words; and some programs use a set of logical formulas to hyphenate words. Dictionary hyphenation usually takes longer than logical hyphenation but is more accurate. Therefore, the most sophisticated programs rely on logic only for words not found in the internal dictionary. *Hyphenation zone* refers to the range of distance from the right margin within which a word may be hyphenated.
Inside margin The left margin of a right-hand (odd-numbered) page or the right margin of a left-hand (even-numbered) page. The inside margin is often made wider than the opposite (outside) margin in order to accommodate binding.
Justified text Text that is spaced out to be flush at both the left and right margins.
Kerning The amount of space between two letters, especially pertaining to certain combinations that must be brought closer together to create visually consistent spacing. The letters AW may appear to have a wider gap between them than do the letters MN, for example, unless a special kerning formula has been set up for the AW combination.
Leading A measure of the amount of vertical spacing between two lines of text. For instance, "10 on 12" would indicate 10-point type with 2-point leading between lines. Nowadays, typesetters refer to this as 12-point leading, basing the specification on the distance from one baseline of text to the next.
Line spacing See *leading*.
Oblique A skewed or slanted typeface such as italic.
Orphans and widows In word processing and desktop publishing, the first line of a paragraph is called an *orphan* when it is separated from the rest of the para-

desktop publisher will benefit by studying a few of the basic rules that govern the layout usage of type on a page.

The first step is to become familiar with the terminology of traditional publishing and with some terms that have evolved over the past 3 years of desktop publishing. Next, you'll need to put this familiarity to work in designing your own desktop publication, one that will invite the reader to take a closer look—by virtue of its visual appeal.

THE LANGUAGE OF TYPE Many of the most foreign-sounding words heard in discussions about desktop publishing tools pertain to type. Terms like *typeface*, *font*, *kerning*, *leading*, *descenders*, *ragged right*, *oblique*, and *hyphenation zone* all

graph by a page or column break. The last line of a paragraph is called a *widow* when it is forced onto a new page or column and separated from the rest of the paragraph. Both are considered undesirable breaks. Some packages let you set up automatic controls for the minimum number of lines that can be separated by a page or column break.

Phototypesetting Producing a page image on photosensitive paper or film, as when documents are printed out on a Linotronic 100 or 300. This process is sometimes referred to as *cold type* to distinguish it from the older method of casting characters, lines, or whole pages in lead (*hot type*).

Pica A unit of measure equal to 1/6 inch, or 12 points.

Point The smallest unit of typographic measurement. There are 12 points in a pica, and 72 points in an inch.

Reverse Refers to text printed with a "negative" appearance. Normally, text is black on a white background; when reversed, it becomes white on black. Graphics can also be reversed, or *inverted*, as this process is called in some systems.

Roman Straight (nonslanted) type, as distinguished from italic.

Rules or ruled lines Black lines of various styles and thicknesses that can be drawn on a page.

Ruler A line running across the screen that measures the page layout in inches, picas, or millimeters.

Running head Same as *header*.

Sans serif A typeface without serifs, such as Helvetica, Avant Garde, and Geneva. See *serifs*.

Screen For our purposes, a measure of gray tone, usually given as a percentage. A 100 percent screen is solid black; a 10 percent screen is light gray.

Script A typeface designed to look like handwriting or calligraphy, such as Zapf Chancery.

Serifs Short lines crossing and embellishing the ends of a letter's main strokes. Typefaces that use serifs include Times Roman, Courier, New Century Schoolbook, Bookman, and Palatino.

Style One of the variations within one family of typeface, such as roman, bold, italic, outline, and shadow.

Style sheet A collection of type specs and format definitions that can be saved and used in many different documents.

Text-only document Text saved without any type specifications or other formatting codes.

Text wrap The ability to shape the text around a graphic image on a page layout. Some systems have an automatic text-wrap feature that will shorten lines of text when a graphic is encountered. In other systems, you need to change the length of lines by changing column margins or by inserting hard carriage returns to shorten lines.

Vertical justification The ability to adjust the spacing between lines of text (leading) in fine increments to create an even bottom margin across columns and pages in a layout.

X-height The height of the lowercase letter *x* in a specified typeface. The *x-height* is a more exact measurement of a typeface than the nominal *point size* (which derives from the size of a piece of old movable type, including a small amount of space around the tallest letter).

—Diane Burns and S. Venit

help describe the appearance of text on a page.

A *typeface*, for instance, is a family of type that has a common, unified, refined underlying design. In Times, for instance, all sizes and styles of type (normal, bold, italic) are variations on the same 26 compatible designs. As a general rule, the letter *a* set in Times will have the same thickness of strokes (relative to the type size) and shape of bowls (rounded openings in the letters) in all sizes, and the italic will be a slanted version of the same basic look.

Typefaces are broadly grouped into two categories: serif and sans serif. The word *serif* refers to one of the fine cross strokes at the top and bottom of, say, the letter *H*. Sans serif means without serif. Times is a serif typeface; Helvetica is sans serif.

Font, derived from the French word *fondre*, orginally meant the process of melting and casting; it once referred to the trays of cast metal letters that a printer used to compose a document. Each tray, or font, included all the letters of the alphabet for a specific typeface, style, and size. One tray, for example, held only 10-point Times italic type, another held only 10-point Times bold, and so on. A *font*, then, came to mean all the characters in a particular combination of typeface, style, and size. Each font can be measured and defined in terms of size, x-height, cap height, stroke weight, and bowl size. More recently, however, *font* has been taken more loosely to mean simply the name of the typeface, such as Times or Helvetica.

Traditionally, the characters of a typeface were individually cast or carved based on designs customized for the size and style of the font. Because fine adjustments in the letters' widths or the weight of the strokes were considered necessary to render a letter more legible in various sizes and styles, the individual character designs across sizes and styles were similar but not identical.

This degree of similarity is still evident in *bit-mapped* fonts used in electronic typesetting, for which each size and style is designed and stored as a separate "font" in the printer. But with *outline* fonts, each letter of the alphabet is "cast" or designed only once to define its shape or outline. This information is then stored as complex curve-fitting equations. A printer that uses a programming language, such as PostScript, to create text can produce the typeface in any size as long as it knows the outline formula of each letter.

When you learn that a certain printer is limited to a specific number of fonts per page or per document, it's important to know which meaning of the word *font* applies. For printers that use outline fonts, a limit of four fonts usually means four typefaces—Times, Helvetica, Courier, and Palatino, for example—each available in

all sizes and styles. Printers that use bitmapped fonts are usually limited to a specific number of fonts in the more traditional sense—10-point Times Roman, 10-point Times italic, 10-point Times bold, and 10-point Times bold italic, for example. The use of outline fonts is the primary advantage of a PostScript printer.

TYPEFACE CHARACTERISTICS In choosing among different typefaces, some designers know the effect a typeface will have on the reader simply by looking at it. Like a connoisseur of good wines, the expert typographer can eloquently describe the characteristics of different typefaces that the average reader experiences only on a subliminal level.

This approach to understanding type focuses on its usage. Body copy typefaces are commonly used for body text (the main "torso" of a document), and they are designed to be legible even in small point sizes. These fonts are usually serif fonts, since serifs help carry the eye along and make the text easy to read. Display typefaces, conversely, are used primarily in display ads and logos, as headings in documents, and as headlines in newsletters. They are often sans serif faces, and they are commonly used in sizes larger than 12 points. Decorative typefaces can be very ornate and are used sparingly for eye-catching announcements.

Descriptions of a few typefaces are included here, and you can extend these descriptions to many similar typefaces.

TIMES AND OTHER SERIF FACES Originally designed for the *Times* of London in 1931, Times New Roman was scientifically engineered to save space in newspaper printing. It became popular during World War II, in fact, because it helped save paper. Later adopted by Henry Luce for his publishing empire in the United States, it has been used by newspapers and magazines ever since.

The typeface family has been extended to include nonroman styles such as italic, and typographers usually shorten the name to Times Roman or sometimes simply Times (you'll still find oxymorons like Times Roman Italic). The typeface name Times Roman is licensed through Linotype AG for use on many popular printers, such as the Apple LaserWriter II and Linotronic typesetters. Imitations, with some variation in quality, have been issued under names like Tms Rmn, Tempora, English, London, Dutch, and Press Roman.

Times, a bookish face, connotes tradition and elegance. Characterized by narrowed shapes and tight letterspacing, Times works best in narrow columns of text, no more than 60 characters wide (or about 4 inches). Add leading between lines if you must use Times in wider columns, to make it easier for the eye to follow. Sizes smaller than 9-point type may need added letterspacing to prevent the serifs of adjoining letters from touching.

■ Like a connoisseur of good wines, the expert typographer can eloquently describe the characteristics of different typefaces.

For wider blocks of text, you should use some other serif font that is designed primarily for legibility, such as Century Old Style, designed in 1906 for the American Type Founders, or its cousin Century Schoolbook (these are available from many sources since their names are not registered trademarks). ITC, International Typeface Corp., licenses proprietary versions of many leading typefaces. ITC Bookman, for instance, is a sturdy, readable face that has become more widely used since Apple built it into the LaserWriter Plus and, more recently, the LaserWriter II NT and NTX.

ITC Garamond originated in Renaissance France during printing's golden age; it remains a graceful, readable serif face with thin strokes that add elegance and conserve space on the page. ITC Cheltenham is a robust typeface suitable to many typographic applications and able to survive poor printing conditions; though the letters are slightly condensed for economy, the characters' interior spaces are open and full, increasing the face's legibility and minimizing the filling-in effect of heavy inking on porous paper.

In direct contrast to Cheltenham, Bodoni is characterized by thick vertical lines and very closed interiors, making it less suitable for body text but excellent for headlines and short blocks of text that require a graceful look. ITC Korinna is marked by short serifs and swelling curves, reminiscent of art nouveau.

Newer text fonts developed specifically for electronic typesetting include Lucida (designed in both a serif and a sans serif set), Computer Modern (a serif or sans serif face that includes many symbols used in scientific books and treatises), and Bitstream Charter (designed for Bitstream to perform well on 300-dot-per-inch printers).

HELVETICA AND ITS KIN Helvetica was designed for the Haas type foundry near Basel, Switzerland, and was named Haas New Grotesque when first produced in 1957. (Grotesque was an early name for sans serif typefaces.) In 1965, Linotype AG issued it under the name Helvetica—the Roman name for Switzerland—and subsequently it became the most widely favored sans serif typeface among countries with markets dominated by Linotype. Helvetica has a straight-forward look. It is considered modern, clean, orderly, and serious.

Since its name is actually licensed from Linotype AG, Helvetica has spawned imitators under a wide assortment of names, such as Swiss. Some imitation Helvetica fonts bear little resemblance to the original letters, but Helvetica's popularity has ensured its availability—in one form or another—on virtually every typesetting or desktop publishing system.

The worst possible use of Helvetica is all caps—say, for headlines—in a centered composition. Its best use is upper- and lowercase, in more than one weight and size, in an asymmetrical composition that uses white space and unequal margins to create action and dynamic tension on the page.

Sans serif typefaces are often used for headings and captions in publications that use a serif face for the body copy. They are

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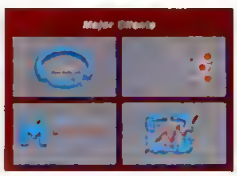


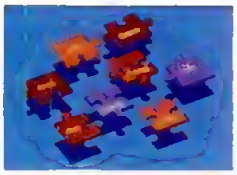




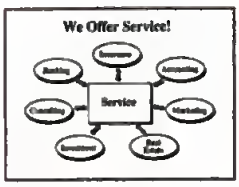


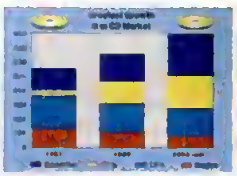


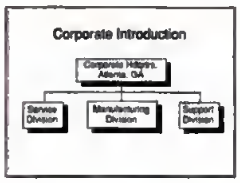


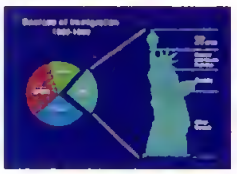




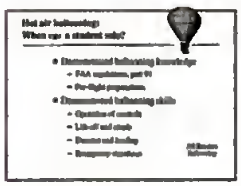


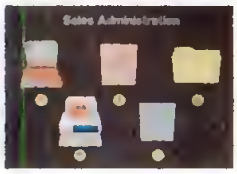




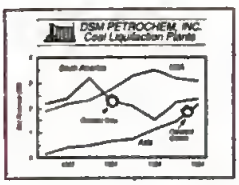


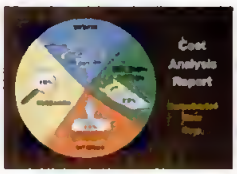


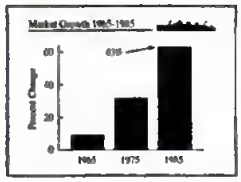


















DOWNLOADING FONTS

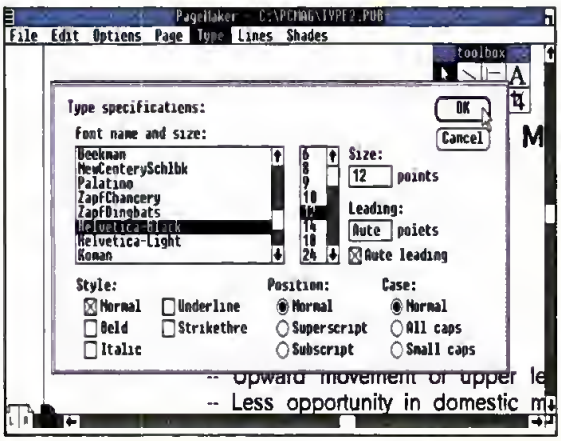
Software fonts offer variety you can't get from your laser printer.

In the world of traditional typesetting, the number of different typefaces a commercial compositor might offer could easily run in the hundreds. Desktop publishing, in its early days, offered a paltry selection of two typefaces: Times and Helvetica. As the market has matured, many more typefaces have become available to desktop publishers who want to break out of the two-font mode.

Although a number of printers, including Apple's PC-compatible LaserWriter Plus and the LaserWriter II NT/NTX models, incorporate seven additional typefaces, the ROM requirements to handle extra typefaces exceed the hardware capabilities of most laser printers. Software can offer you more with downloadable (or soft) fonts. These have become a necessary part of the desktop publisher's toolbox.

For downloadable fonts, information about what a given font should look like is stored on-disk. That information is sent to the RAM of a printer, either in a batch file before printing or during printing as it is needed by each application. In addition to the font information needed by the printer, an image of the font must be created for the screen.

In the case of PostScript fonts, most of which are available from Adobe Systems, you purchase a disk that contains all the styles of a particular typeface. The Garamond disk, for example, includes Garamond, Garamond Italic, Garamond Bold, and Garamond Bold Italic. The font information is installed on the PC hard disk, along with a program for sending the fonts to the printer (which must be done before they are used). Once the fonts are in the printer, the user has all the advantages of PostScript fonts: the fonts can be scaled, making them available in any point size within a generous range—usually from 4 points to 127 points, depending on the application.



PageMaker's *Type Specifications window is where you select font, point size, type style, and other options for a previously defined block of copy. The font list displays typefaces built into the LaserWriter NTX, along with two downloadable faces, Adobe Systems' Helvetica Black and Helvetica Light.*

Most PC users today do not live in the world of PostScript, but in the world of the HP LaserJet. Happily, a solution to the font problem has been provided by several developers in the form of downloadable fonts. The most aggressive placement of new typefaces for the HP LaserJet has come from two companies—Bitstream and VS Software. With Bitstream's *Fontware* package, LaserJet users have an ever-growing variety of faces available.

To use *Fontware*, you must install the fonts you wish to use on your hard disk. Unlike PostScript typefaces, these fonts must be installed in the specific sizes needed. The Bitstream fonts can be installed for use with either *Ventura Publisher* or *PageMaker*.

In the *Fontware* installation program, you first choose which typeface style you wish to install, then indicate what sizes you want for each typeface. A typical list for body copy might read 7, 9, 10, 11, 12, 14, 18, and 24, for example. Headline fonts might be chosen in sizes like 18, 24, 36, 48, and 60. The installation program compiles the font information for each size chosen and installs it on your hard disk. You need to be sure you have plenty of disk space and time; our first installation of about a dozen sizes in six different faces took over 3 hours.

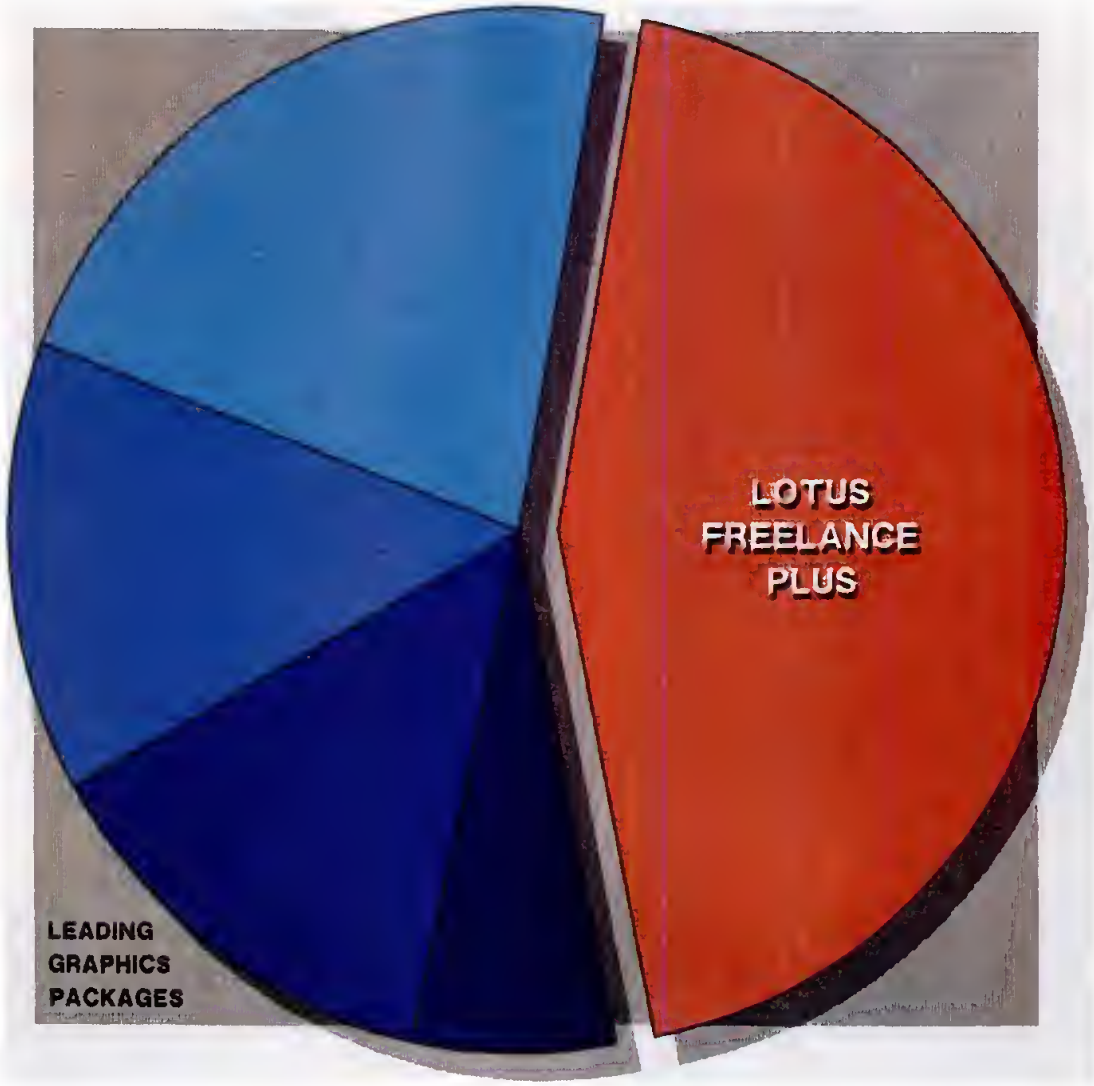
After installation, the font information is sent to the LaserJet by the application program in use. It's an exciting moment when the LaserJet, which could formerly print only Times and Helvetica from a font cartridge (and in just a few sizes at that), produces pages with large point sizes and new typefaces like Cooper Black, Souvenir, and Futura.

The excitement exacts a price: more printer memory and more disk space are required than with PostScript fonts. Graphic designers will be frustrated at not being able to choose just any size type. But for most PC desktop publishing applications, these fonts offer an extremely cost-effective alternative to the pricey PostScript route.

—Diane Burns and S. Venit

also commonly used in forms, price lists, and catalogues where economy of space and maximum legibility are important. If Helvetica seems overworked in your document, use another sans serif typeface in its place. ITC Avant Garde and ITC Avant Garde Gothic (based on the logo of *Avant Garde* magazine in 1970) are both graceful, open sans serif typefaces composed of perfect circles and triangles. Both Avant Garde and Avant Garde Gothic are available for most printers.

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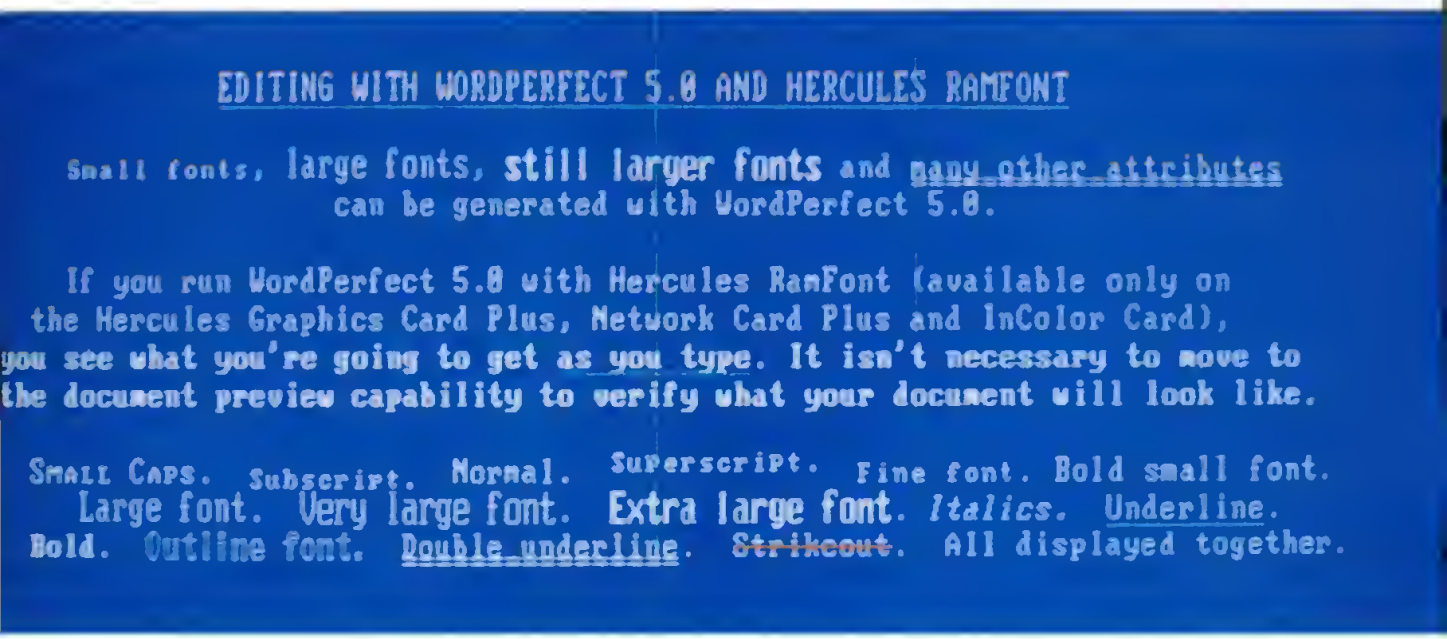
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CIRCLE 513 ON READER SERVICE CARD

PRINCIPLES OF GOOD DESIGN Given a knowledge of different typefaces and the underlying principles that designers and typographers follow, the next step for desktop publishing is to master a few guidelines to put this understanding to its best use. Keep in mind that few documents will conform with *all* of these guidelines. The mark of a good designer is knowing when and how to break the rules.

1. Don't use more than two typefaces in a document. Most published works use a greater variety of typefaces than the traditional business report, which was usually plain Courier and Courier bold—all in one size. When you switch from a letter quality printer to a laser printer for your business reports, the wide selection of typefaces may at first seem confusing, not to mention tempting. Magazines and newsletters often include many more typefaces than business reports, books, and manuals—especially when you count all the typefaces used in display ads. But if you are unsure about what typefaces to use, the basic principle of simplicity remains the best guide. Usually, when two typefaces are used, one typeface is serif and the other sans serif. Use variations in size and style to distinguish among different elements.

This rule can be difficult to follow when graphic images are derived from several different programs. The number of fonts available with a spreadsheet charting program may be more limited than the number available in a drawing program, and both types of programs are likely to be more limited than the page layout program when it comes to setting fonts. You should be familiar with the font options in all of the programs you'll be using before deciding on the final specifications.

2. Be conservative. Brochures often use decorative or unusual typefaces for the headings, and sometimes for the body copy as well. The typeface can convey a sense of seriousness, elegance, or frivolity. If you don't know how different faces affect the reader, it's best to stick with the more-traditional faces rather than experiment with the more-decorative ones.

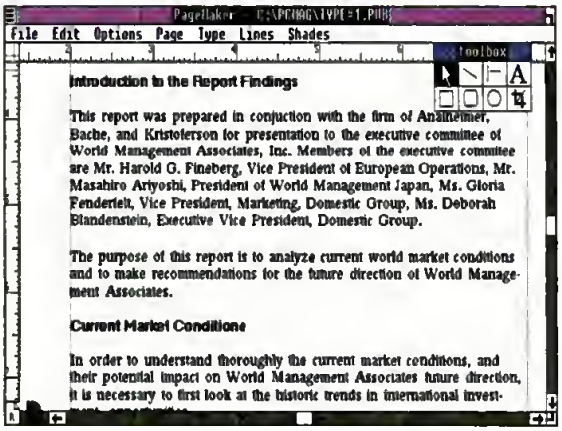
3. Within one typeface, use variations in size and style to distinguish among different heading levels. One common exception to this rule is the lowest heading level, which might be bold or italic type in

THE GOOD, THE BAD, AND THE UGLY

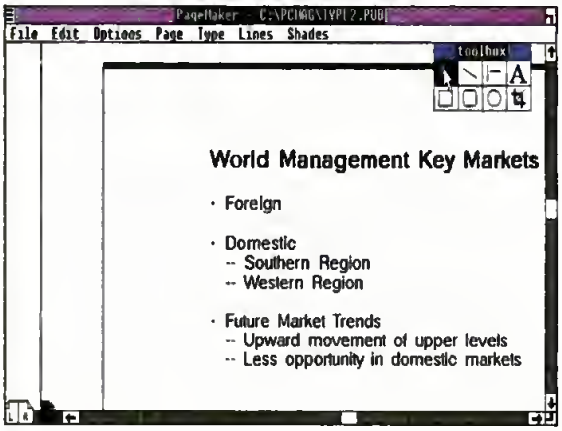
A straightforward approach to desktop publishing can be the key to good-looking output.

Desktop publishing programs put many fonts, rules, and images at the disposal of the user, but they become the enemy of good design if you attempt to crowd all of these into your presentations. Just because a program gives you 11 different typefaces doesn't mean you should use them all in one document. If you want the reader to notice the report's content and quality more than its fancy borders, never clutter it with a variety of rules, symbols, and fancy typographical tricks. Good use of white space and a minimalist approach to font selection will result in attractive, easy-to-read output.

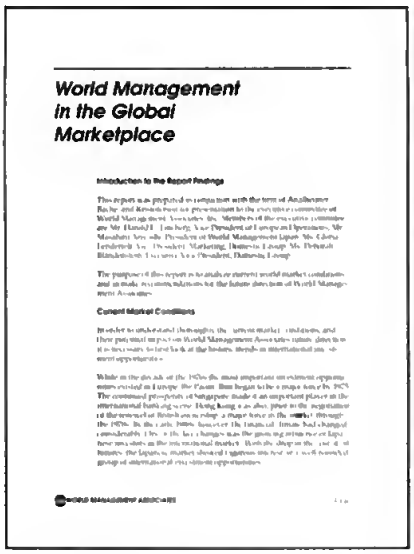
The screen shots shown below indicate how you would use *PageMaker* to spec your file. The output at the near right illustrates the clean, straightforward output you'll receive by following a few simple rules of good design. The output on the far right shows what happens if you go overboard in selecting fonts and rules. The numerous dark borders tend to draw the reader's eye away from the information being presented.



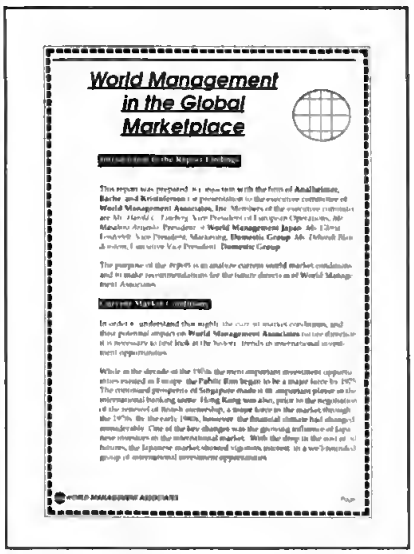
We produced our report sample on the PC using PageMaker, *desktop publishing's grande dame, and the Apple LaserWriter NTX. Rulers across the top and left are an optional feature; they help the user in spacing type and choosing other specifications.*



Although PageMaker's *toolbox (at upper right) allows you to draw rules, boxes, and circles, keep in mind that overhead transparencies must remain simple to achieve their desired effect. In this example, the Lines selection on the menu permitted us to thicken the box's upper border.*



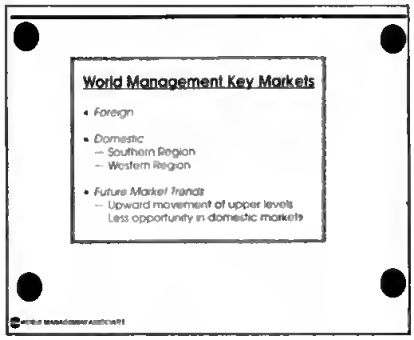
For maximum readability, it's best to stick to only two typefaces in any document. Palatino, a serif face, is used in the body copy above to help carry the reader's eye along. For the headings, we chose the sans serif Avant Garde, a graceful, open typeface that's available for most printers.



This modified version of the report sample to the left illustrates the damaging effect of the untrained desktop publisher's creativity. Detracting from the report's serious message is its adornment with excessive borders, underlining, reverses, and boldface and italic type styles.



For material that will be projected as slides or overhead transparencies, using only one typeface achieves the best visual effect. Avant Garde is used here as an alternative to the more widely used Helvetica. As a rule of thumb, the image on the paper page or film (before projection) should be legible from about 10 feet away; important words should be no smaller than 36 points in size.



The extra frills added to our overhead transparency do nothing here to enhance the message of the text. The distractions in this presentation include the heading's overemphasis (accomplished through underscoring), the corner graphics, and the mix of roman and italic type.

the same size and typeface as the body copy.

4. Use italics rather than underscores within body copy. Underscored text was a convention developed for use in documents typed on a typewriter or printed on letter quality printers; it was never meant to replace italic when both are available.

5. Use all caps as a deliberate design strategy, rather than as a method of showing emphasis or differentiating heading levels. If you're coming from the tradition of using letter quality printers, you might be accustomed to using uppercase type for this very purpose—to add emphasis or distinguish headings. This can still be a useful method in cases where other variations in size or style are not possible, and it can still be a part of your deliberate design strategy.

Don't use all-uppercase text or headings, however, just because "that's the way the author typed it." Consider, for instance, changing all-cap headings to bold or italic. Use variations in size rather than all-cap text to differentiate headings. Here, an exception occurs when the list of available fonts is too limited to accommodate all heading levels; in this case, all caps can be used to distinguish between two heading levels that are otherwise the same font. Text set in all capital letters usually requires kerning.

6. For images that will be projected as slides or overhead transparencies, use large point sizes for the text. We recommend that the image on the paper (not the projected image) should be readable from approximately 10 feet away. For most large audiences, this means that important words should be no smaller than 36 points in size. For slides, an image on 8½- by 11-inch paper should be readable from 7 feet away. This means that the text can be 24 points in size—slightly smaller than that used on overhead transparencies.

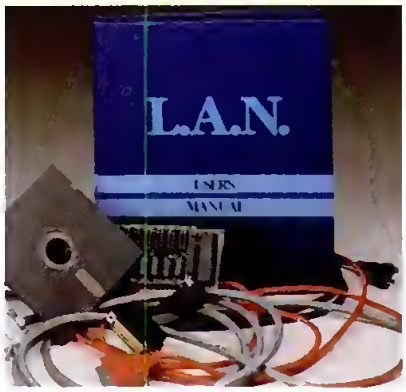
TYPE SPECIFICATION An early step in the process of document design is listing all the fonts available for use in your design specifications, based on your system's current font library.

This step was less important in traditional typesetting environments, where literally hundreds of fonts were available through commercial typesetting services. When this many fonts are available, expe-

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CIRCLE 288 ON READER SERVICE CARD

rienced designers often sketch out their rough ideas for the design first, and then check their specifications against the typesetter's catalogue of fonts. In a desktop publishing environment, it's far more likely that the number of typefaces and fonts available will be limited (unless you're a service bureau supporting a wide range of clients).

The next step is to select the fonts you'll actually use in a particular publication. One reason for limiting the number of fonts you use is our basic design principle: winning designs use only a few fonts on each page. Another reason is a practical one: some printers cannot handle more than a few fonts per page or per cartridge. Be sure to learn your system's limits before choosing combinations of fonts.

An important factor in choosing how many fonts you need is the number of text elements used in the document. Elements that require differentiation can include:

- Chapter titles, section openings, or feature article headlines.
- Different levels of headlines or subheads.
- Body copy.
- Figure captions.
- Labels within figures.
- Footnotes.
- Special sections like sidebars, summaries, and tables.
- Table data.
- Running headers and footers.

Each element can be further broken down and matched with type specifications. In the footer, you may wish the page number to be bold and the section name italic. Desktop publishers have a tendency to want a different font for each element. This is a good idea within limits. By studying other published works, you'll see most books use only one or two different typefaces, and variations in size and style are used sparingly.

MORE THAN A MATCHING GAME

The design process involves more than simply matching the fonts in your type list with the document's list of text elements. Complete specifications should include alignment (left, right, centered, or justified); leading (spacing between lines); and kerning (spaces between letters). Additional specifications can include indicating when to use uppercase letters (all caps), upper/lowercase (initial caps), an oversized cap (at the beginning of a document or chapter), a drop cap (which is similar, but "sunk" into the text), small caps, inverse or negative leading, and other special effects.

Beyond considerations of type placement, ruled lines and borders can help organize or emphasize your message. A line above subheads in a document, for instance, helps clarify the structure of the text. Simple hairline rules between columns of a newsletter help the eye read

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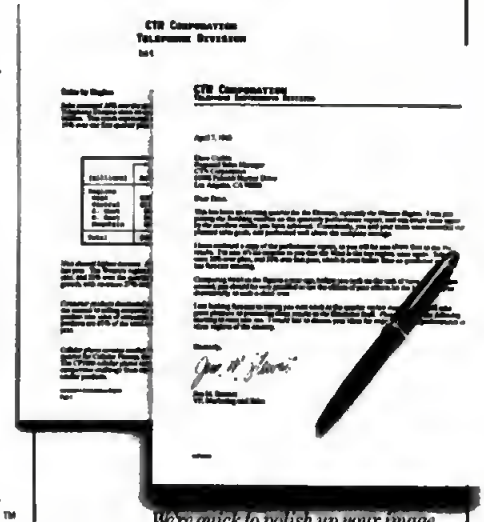
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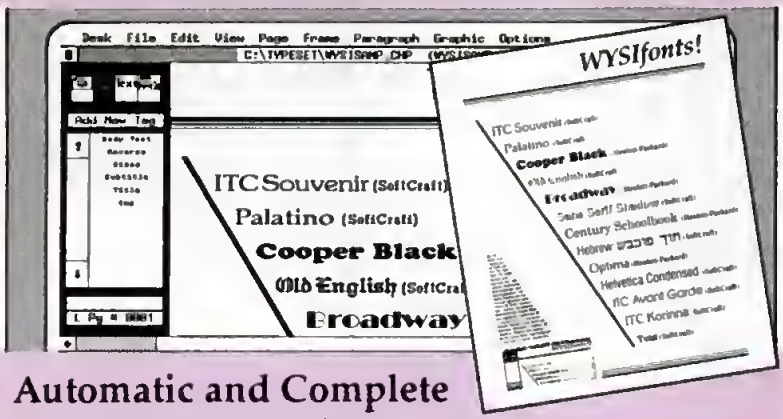
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more quickly, and can help the page seem more inviting to read. A box around a paragraph of text can add the appropriate emphasis or make the information more easily referenced, say, in the case of a technical manual.

Just as beginning desktop publishers tend to use many different fonts on a page simply because they're available, ruled lines and borders can likewise be used in a way that wreaks havoc on a page. As with type, let simplicity be the constant rule.

Other special effects include adjusting the hyphenation zone and the raggedness of ragged-right text. Beginning desktop publishers can accept the defaults for these settings that are built into most word-processing and page-layout applications, and learn by experimenting with different settings in short documents. These variables can also be adjusted when the author's text (the "copy") does not fit the space allowed in a newsletter or magazine.

FIRST LEARN THE RULES In the realm of pure design, professionals can break all the rules and still get good results, but those approaching desktop publishing with no prior skills in graphic design are advised to follow these guidelines until they are thoroughly practiced. After mastery of the basics, experimentation may begin.

The fastest way to acquire a sense of design is to study and imitate published works that are similar in structure to your document. Match your design specifications as closely as possible to the published documents, selecting fonts that are similar to those used for headings, body copy, and captions in your models. You need not match the typefaces exactly, but try to stay within consistent categories (serif or sans serif, roman or italic or bold).

As you gain experience using different typefaces, you'll gradually be able to distinguish among graphic elements and gauge their effect on readers. You'll publish your work with confidence that its design will support—not contradict—your intended message. PC

Diane Burns and S. Venit are owners of TechArt San Francisco, a graphic design and production shop. They are frequent contributors to PC Magazine.

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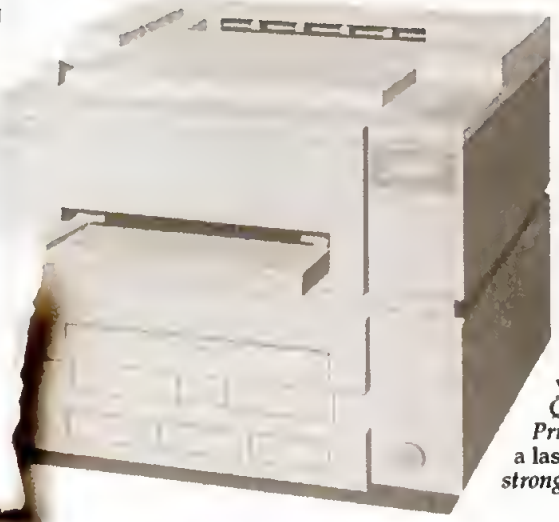
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GETTING THE FAX

Like a brush fire, the word about PC fax technology is sweeping through the business world. This new graphics communication medium is poised to revolutionize the way text and graphics images are moved between businesses. With a PC fax system you can speed whatever appears on your PC screen across the continent in less than a minute to a destination that can be another fax-equipped PC or one of the nearly 3 million fax machines already in service worldwide.

Like a brush fire too, PC fax can burn you badly. If you're improperly prepared or expect too much, you may be disappointed after spending thousands of dollars on equipment that can complicate your life rather than simplify it. While fax boards can ease the hassles of transmitting documents from one person's hard disk to another in a distant city, PC fax encounters problems of its own when the boards are used in combination with scanners and printers.

PC fax technology stands in about the same position as desktop publishing did a year ago. PC fax, like desktop publishing, is no panacea. It can work miracles, but making those miracles is itself work—perhaps more than you'd expect. Like desktop publishing, PC fax is a technology you'll have to master to turn its promise into useful reality. So far, the market for PC fax has not exploded like the market for standard fax machines has. In the United States, only about 15,000 PC fax boards have been installed, compared with more than a million installations of standard fax machines.

FAX MARCHES ON Fax stands for *facsimile transmission*—sending graphic images through the telephone system as a series of scan lines, the same way that a television picture goes through cable.

Alexander Bain is generally credited with inventing fax in 1842. Bain's device was able to receive wire signals and record them as images on paper. However, no less a source than the *Encyclopedia Britannica* credits a London inventor, F. C. Bakewell, with the invention of fax in his

Fax boards for the PC can cut your costs for overnight courier services and enhance office productivity. But are they always the best investment?

1850 patent of a "copying telegraph" that transmitted images penned on paper in varnish.

Not surprisingly, it wasn't until the advent of telephones that fax really got its start. By the mid-1960s more than 40,000 fax machines, products of Bell Telephone, were installed. But about that time the FCC's Carterphone decision, which held that devices other than Ma Bell's own could be linked to telephone networks, made fax a competitive industry—and one that required standardization.

Standardized specifications for sending facsimile along analog telephone lines were set by the Consultative Committee on International Telephone and Telegraph (CCITT), an arm of the United Nations headquartered in Geneva, in what was known as the Group 1 and Group 2 standards. Group 1 standard machines communicated much as 300-bit-per-second modems did: a single page took approximatly 6 minutes to transmit. Group 2 machines were twice as fast but still slow by today's expectations.

The fax fire was truly ignited in 1983 when the CCITT adopted the Group 3 standard for digital communications. Group 3 machines use data compression schemes and send information at a fast 9,600 bps, cutting transmission time to as little as 30 seconds per page.

The Group 3 standard also allows two levels of resolution: one of about 200 by 100 dots per inch, and a somewhat higher resolution that achieves 203 by 193 dpi but can double transmission time. Group 3 machines (which, it is estimated, make up about 90 percent of the faxes installed in offices today) are also compatible with Group 1 and Group 2 machines (though none of the PC boards reviewed here is backward compatible). Group 3 machines can be had as cheaply as $525, but the typical model ranges in price from $1,000 to $2,000.

More recently, the CCITT approved a Group 4 standard, ushering in machines that are even faster and that produce even crisper images. Group 4 fax machines achieve a resolution that compares well to that on a laser printer—300 by 300 dpi—and can send a page in about 5 seconds, but they require special, dedicated digital lines that currently must be leased. It may not be until well into the next century that Group 4 fax becomes practical for everyday use over everyday phone lines—if it does even then. It was only this spring that an integrated services digital network (ISDN)—the network over which Group 4 must operate—was introduced in Norcross, Georgia. The Baby Bells are expected to implement ISDN in their various regions over the next two decades. But, even after those networks are established, the lines connecting those regions must also be part of an ISDN for a Group 4 fax machine in, say, Arlington, Virginia, to talk to a Group 4 fax machine in Cupertino, Califomia. Presently, the cost of leasing a line (not to mention Group 4 price tags that hover around $10,000) makes the standard impractical for all but large corporate users with a heavy volume of fax traffic.

HOW IT WORKS In the 1980s you have four ways of sending a fax: from fax machine to fax machine, from a PC using one of the products reviewed here to a fax machine, from a fax machine to a PC equipped with one of these products, and from PC to PC when both are equipped with fax boards.

You program into the fax machine the number of the person who will receive the fax, and then transmit.

A directory of 85,000 fax numbers in the United States and 72 other countries is published by FDP Associates (One Park Ave., New York, NY 10016-5801; (212) 503-4100). Named *The Official Facsimile User's Directory*, it costs $65 and lists 27,000 fax numbers by the name of their organizations, identifying them by geographical location and department. It also lists the name of the operator, the operator's phone number, the office hours at the location, and whether the receiving machine is manually operated or is on automatic 24-hour operation.

In normal fax (without the PC prefix) a paper-based image is fed into a fax machine, and the classic "reasonable facsimile of same" emerges from the photostatic printer of a distant fax. PC fax combines the standards and techniques of ordinary fax machines with the intelligence and data manipulation abilities of the PC. On-screen images and text files are converted to fax format, compressed, and transmitted through a fax board (a special internal high-speed, auto-dial, auto-answer modem). At the other end of the connection, PC fax can capture this transmission or anything created by a standard fax machine, display it on a PC screen, and print it out on a dot matrix or laser printer.

A PC blessed with fax can be programmed to distribute fax transmissions to one or many recipients at preset times or to poll distant fax machines for images on demand. Include a scanner, as well as a printer, among your peripherals, and you can substitute PC fax for a standalone fax machine. That, however, is an expensive proposition that you probably wouldn't want to consider unless you have other needs for a scanner. PC fax boards are expensive. Although Quadram's JT-Fax lists for a reasonable $395, most boards will top $1,000 in price. That is comparable to most standard fax machines until you consider how you are going to get images in and out of your PC. If you are going to do more than transfer ASCII files from your hard disk, you will need a scanner to feed in the image and a printer to get it out.

The key benefits of PC fax are its speed and standardization. While character-based 9,600-bps modems are a persnickety lot and generally only communicate when the equipment at both ends of the circuit is matched in model and manufacturer, Group 3 fax transmissions are universally understood by standalone Group 3 fax machines and PC fax boards. But fax files are sent as graphics.

That's fine if all you want to do is see the file on your monitor, like a picture on a TV screen, or freeze that file by printing it out. If you want to deal with it as ASCII text, plugging it into your favorite word processor to edit the file, you'll need OCR (optical character recognition) software to convert the file back into ASCII text. Some PC fax packages include this capability. Three of the boards that we reviewed—the GammaFax, Beyond Fax, and Fax Partner—have high-speed modem capabilities that let you send text files at 9,600 bps—but, in that mode, the boards suffer from the same compatibility problems that you encounter with 9,600-bps modems: the PC at the other end must be equipped with the same board you have in

ALTERNATIVES TO FAX

Your PC has no fax board. You need to get that document off your screen and send it to the other side of the country. What do you do? Try one of these.

PC facsimile boards are expanding the fax market, but they may not be the most efficient fax method for every PC user. Businesses that don't need to transfer documents often may find it difficult to justify the cost of a fax board and scanner—or even the cost of a standard fax machine.

There is help, however, for the smaller business and the occasional fax user who can't justify the expense of facimile equipment.

From their PCs such users can access Western Union's EasyLink, an e-mail service that costs $25 a month. With EasyLink you can compose documents on your favorite word processor, dial up EasyLink, designate the fax number of the person who should receive the document, and send it. Currently, the service can handle only straight ASCII text files—without company logos and a signature—and can only *send* documents. To expand its service, Western Union plans to add capabilities for receiving faxed documents by the end of the summer. In addition to the monthly rate, EasyLink costs 55 cents for the first half-page (1,250 characters) and 35 cents for each additional half-page.

Electronic Courier Systems Inc., based in Eatontown, New Jersey, offers a document translation service called Xpedite, through which you can send formatted text files. ECS accepts a file, translates it into a fax format, and sends it to a fax number you designate in a document header. The document speeds along at the rate of about a page per minute. The Expedite software costs $130, and a modem-like store-and-forward device that connects to your PC is available for an additional fee. ECS charges for each transmission at a rate of 80 cents for the first page and 65 cents for every additional page.

Hotelecopy, a large facsimile service bureau networked through most of the country's major hotel chains, is equipped to work with PC faxes. As with all service bureaus, you can send a fax to a Hotelecopy office near the document's destination, and the office will hand-deliver it. Also, you can visit a Hotelecopy location to send a hard-copy document to an office with a fax machine or PC fax system. Hotelecopy performs PC-to-fax file conversions using GammaFax boards and can send text files composed on a PC. Charges, paid only by the sender, include a rate of $9 for up to ten pages (60 cents per page after that) plus whatever phone charges and taxes may apply.

—Paula Seefeldt.

Paula Seefeldt is an editorial assistant at PC Magazine.

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your machine. (See *PC Magazine*, April 26, 1988, "Built for Speed: 9,600-bps Modems" for more on compatibility problems in high-speed modems).

Note, too, that the standardization of fax data applies only to telephone transmissions. Since every PC fax system uses its own disk file format, you cannot directly interchange fax files between different systems.

THE STRAIGHT FAX Using PC fax to move paper-based images is a substantially more complex operation than transmitting documents via a fax machine. Any clerk, secretary, or executive who is relatively unschooled in the ways of a PC can nevertheless operate a fax machine with little trouble or training. PC fax requires some knowledge (and confidence) in running a computer. It requires you to boot up the machine, run the software, ply your way through menus, and make sure that the ancillary equipment is powered up and ready. If you want to ship document A to point B, pushing it through a dedicated fax machine is easier, cheaper, and less frustrating.

PC fax, therefore, shouldn't be considered as a replacement for standard fax machines. It does, however, make a nice complement to standard fax in an office where typists compose their documents on PCs and then spend a lot of time waiting for those documents to be printed so that they can then stand in line at the fax machine waiting to send those documents across the country. If you want to move text that you've written on your word processor to Anchorage or Taipei, PC fax is quicker and less complicated. The same is true for pictures that you've brushed up

through *PC Paint* or combination images you've created with *PageMaker*. Often you even get better quality at the distant end of the connection.

Many PC fax programs know how to manipulate electronic images to yield the best quality output, which, if your document is being sent to another fax board, is usually delivered on a laser printer that uses standard paper—not the thermal variety. Files sent from a PC to a fax machine also tend to come out with better resolution than do documents sent from one fax machine to another.

Your PC can also be the base of an attack-fax system. Instead of feeding the same sheet through your Group 3 machine a hundred times for a hundred different recipients, you send all the copies at once with a couple of keystrokes on your PC. Your PC fax program will churn out all the copies to everyone on an electronic mailing list with little more bother than it takes to send one. Some standard fax machines also allow you to create distribution lists, but these machines usually come with premium price tags, costing you as much as or more than a PC fax system.

Moreover, because PC fax follows the same standard as the dedicated fax machines, each of those 3 million installed fax engines can essentially operate as a remote printer for your computer. If you're good at technological jigsaw puzzles, you may have already fitted together a winning system. For instance, you can create a newsletter with your desktop publishing package, blast it through your PC fax system, and have it instantly delivered worldwide (or in the wee hours when phone rates are cheaper). All the needed technology exists today. GammaLink, maker of the GammaFax board reviewed here, even offers a device driver that lets you print *PageMaker* or other *Microsoft Windows* applications directly to fax. Similarly, the Smartfax board from American Data Technology, also included in this review, lets you directly transmit formatted documents created in *WordStar* to a fax machine or another Smartfax board without taking them through an ASCII conversion.

FAX OF THE JOB Boards like those reviewed here—GammaLink's GammaFax, American Data Technology's Smartfax, DEST's EZ-Fax, Quadram's JT-Fax, Brook Trout Technology's Fax Mail 96, Datacopy Corp.'s MicroFax, Microlink's Beyond Fax, Complete PC's Complete Fax Board, Panasonic's FX-B88/89 Fax Partner, and OAZ's XaFax—are meant to be the tools you use to take advantage of the technology. Like all tools, some of these are better suited to particular purposes than others.

At heart, all PC fax hardware is more or less the same. Most use the VLSI (very large scale integration) chips made by Rockwell Corp. These chips cut costs, increase reliability, and practically guarantee that all of these fax systems will be equally impervious (or susceptible) to line noise and completely compatible with the signal requirements of both the telephone system and the Group 3 standard.

The big difference in these PC fax systems is software. Most systems give you menus to keep the inherently complex process manageable, but the menu hierarchies differ substantially. Some, for example, make sending the same fax to a list of people quick and easy; others are demanding and confusing.

PC fax systems also differ in their capabilities. For example, some systems allow you to manipulate images before you send and after you receive them; others relegate image-editing to other programs that you must purchase. While some PC-to-fax systems won't flinch at 100-page transmissions, others balk.

Ease of installation is another variable to consider. The fax boards reviewed here vary in how widely compatible they are with scanners, printers, and other fax machines. Some require extensive configuration. While extensive setup procedures may not pose a problem to members of an MIS department who have the technical knowledge to do tricky installations, they could easily overwhelm a PC novice in a small office who has no one but himself to turn to for setup. In our tests, the powerful and versatile GammaFax board proved to be particularly tricky. Though its powerful script language allows a technically knowledgeable person to automate the system with batch files that will make it incredibly easy for a novice to use, the novice who expects to install and configure it could easily get lost.

If you need a fax board now, you should carefully consider each product reviewed here and match its capabilities to your needs. If your need isn't immediate, you may want to delay a purchase and investigate what the next generation has to offer. PC fax is a young technology and, with one exception, the products we reviewed looked like they were still in development. We found inconsistent user interfaces within the software, menu choices that were not implemented, and commands that were not well documented or not documented at all. Most of the companies whose products were reviewed reported scheduled releases of new software shortly after the testing for this review was completed.

Still more, including the market leaders of standard fax machines (Ricoh and Pitney-Bowes), were developing new boards at the time we did these reviews; hence, the ones they marketed previously are not represented here. Other companies with boards in the pipeline include USA Lightspeed, King's Park, Pacific Image Communications, and Skyworld. Rumors also abound that Brother and Intel are developing boards.

Fax boards from Scicom and Commu-

OUR REVIEWERS

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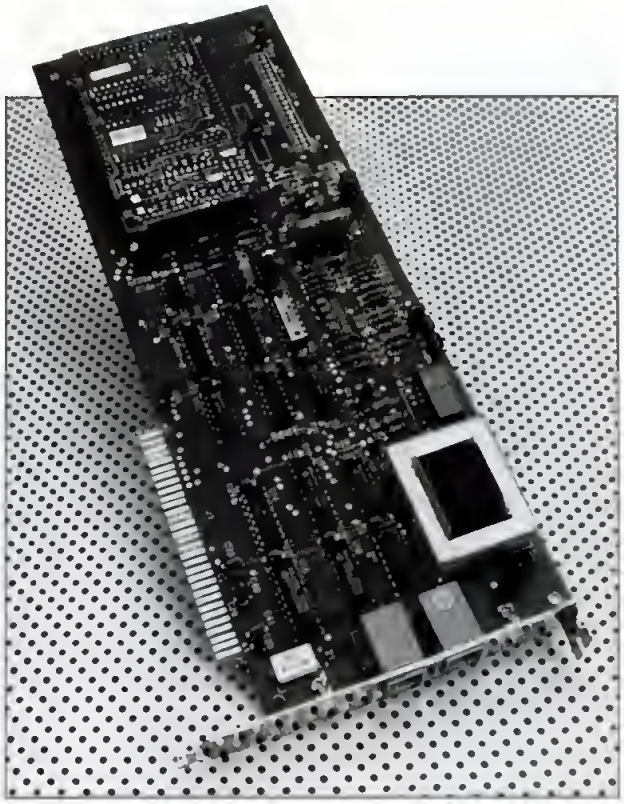
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nication Technology, reviewed in earlier *PC Magazine* articles on fax boards (see "PCs and FAX Get It Together," June 23, 1987, and "Just the Fax," January 26, 1988), were not reviewed here because the companies did not respond to our requests for review products. Unfortunately we received software for TEO Systems' FCS Infax too late to include the board in this review. We also did not review the Datavue board, a private label of Quadram's JT-Fax, which lists for the same price ($395) and is the same as the JT-Fax.

—Winn L. Rosch and Carol Ellison

Winn L. Rosch is a contributing editor of PC Magazine. *Carol Ellison is an associate editor of* PC Magazine.



To install American Data Technology's Smartfax, you set jumpers on the board, connect your phone line, and run the software's installation program. Smartfax is a three-quarter-sized board. The system, which lists for $949, can accept six different document types.

AMERICAN DATA TECHNOLOGY INC.

Smartfax

Smartfax, from American Data Technology, is a three-quarter-sized internal fax board with accompanying software. Priced at $949, it offers many features that help make PC fax transmissions pleasant—and some that don't.

Installation involves setting jumpers, popping the board into place, connecting the phone line, and running the installation program. If you specify a laser printer in the configuration program without physically connecting one, the program freezes.

Smartfax can accept a number of document types, including its own fax format, *Dr. Halo*, *WordStar* (with format preserved), ASCII, *PC Paintbrush*, and TIFF. Some of these are supported outside of the main program with a set of conversion utilities; others are supported directly. With ASCII, *Dr. Halo*, and *WordStar*, you can convert to fax format during transmission or you can preconvert. Based on my experience, preconversion is considerably faster.

Preconverting is the only way to store the converted image to disk. Converting during transmission creates a slew of temporary files that are automatically deleted once the message is received. There is no gray scale—a problem if you plan to transmit photos.

Smartfax has features that anyone who needs to fax documents internationally will adore. There's a "world time" table that displays a graphic representation of time zones (to let you know who in the world is awake to receive your fax). There's an alphabetical country-code reference, an area-code table, and a nifty usage summary that supplies an overview of what documents you have sent (or received), to whom, and how often.

HOW TO COMMUNICATE The Smartfax main menu bar includes seven fairly self-explanatory selections: Communications, Editor, Conversion, I/O, Facilities, DOS, and Spooler. The Communications component contains both automatic and manual transmit and receive modes, a scheduler, and a message log.

To maximize automatic transmission for multiple documents or multiple sites, you'll want to use the scheduler. You specify the filename, type of file, and phone number (which can be taken from the phone book), then indicate when to send, redial, and back off. The list of instructions is saved as a single file. The scheduler has no polling features to set up periodic transmissions; it cannot be used to ready files for transmission when polled by another machine, and it can handle transmission of messages only for today, not for some future date.

Reception is best in automatic mode. When a message is received, the result ("Good" or "Error") is printed immediately—a nice feedback. One problem: since the system has no check for duplicate

PC MAGAZINE FACT FILE

Smartfax
American Data Technology Inc.
44 W. Bellevue Dr., #6
Pasadena, CA 91105
(818) 578-1339
List Price: $949
Requires: 640K RAM; PC/XT/AT or compatible; hard disk; EGA, CGA, or Hercules video card; DOS 2.0 or later
In Short: Attractive features here include background operations, separate In and Out logs, a graphics editor, a simple scheduler, both manual and automatic transmission, and a world time map with a list of country and area codes. But a number of details still need attention.

CIRCLE 652 ON READER SERVICE CARD

Photographs: Thom O'Connor

Intelligent Micro Systems



IMS-286/12MHz

Base System $1125

- 80286 processor running at 12MHz, zero wait state, switch-selectable to 6MHz
- 1MB RAM
- 1.2MB diskette drive
- Dual diskette drive/fixed disk controller
- Enhanced, 101-key keyboard
- 200-watt power supply
- Illustrated installation and operations manual
- Clock/calendar with battery backup

Base System with Monographic Card and Monitor $1255
- With 40MB Seagate (30ms) $1695
- With 70MB MiniScribe (28ms) $1995

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For PC/XT ®: Serial, parallel, & game ports $65



Math Coprocessors

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80287-10 math coprocessor $349

1200 Baud Internal Modem

With communications software $69





Diskette Drive

360KB or 1.2MB diskette drive to enhance your system
360KB $99
1.2MB $109

Multifunction Cards

For AT: 0KB expandable to 1.5MB, serial and parallel ports $110
For PC/XT: 384KB; serial, parallel, game ports, clock/calendar with battery backup $199



Mice

Logitech Serial Mouse: programmable, three buttons $79
Microsoft Bus Mouse: mechanical mouse includes bus interface $119

IMS-286/10MHz

Base System $965

- 80286 processor running at 10MHz, switch-selectable to 6MHz
- 1MB RAM
- 1.2MB diskette drive
- Dual diskette drive/fixed disk controller
- 200-watt power supply
- Enhanced, 101-key keyboard
- Illustrated installation and operations manual
- Clock/calendar with battery backup

Base System with Monographic Card and Monitor $1095
- With 40MB Seagate (30ms) $1545
- With 70MB MiniScribe (28ms) $1835

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The Intelligent Solution



IMS-88/10MHz

Base System **$495**

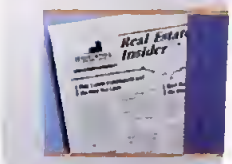
- 8088 processor running at 10MHz, switchable to 4.77MHz
- 640KB RAM
- 360KB diskette drive
- Diskette drive controller
- Keyboard
- 150-watt power supply
- Illustrated installation and operations manual

Base System with Monographic Card and Monitor $625
- With 20MB MiniScribe (65ms) $885
- With 40MB MiniScribe (61ms) $995

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CIRCLE 382 ON READER SERVICE CARD

Fax Systems: Summary of Features

(Products listed in ascending price order)

FAX FEATURES	JT-Fax	Complata Fax Board	Smartfax	Fax Mail 96	GammaFax	Panasonic FX-B88/89 Fax Partner	MicroFax
List price	$395	$499	$949	$995	$995	$999	$1,195
Standard Group 3 speeds (bps)	4,800, 2,400	4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400	9,800, 7,200, 4,800, 2,400
High-resolution mode	●	●	●	●	●	●	○
Transmits gray scale	●	○	○	○	○	●	○
Transmits compressed fonts	●	●	○	●	○	●	○
Can include document header	●	Optional	●	○	○	Optional	●
Max. no. of pages transmitted	999	Unlimited	999	99	Unlimited	Unlimited	5
Does polling	○	●	○	●	●	●	●
Runs in background mode	○	●	●	●	●	●	●
TRANSMISSION FEATURES							
Direct from scanner	●	●	●	○	●	○	●
PrtSc sends current screen	●	○	○	●	○	○	●
Saves current screen to file	●	○	○	●	○	●	●
Directs printer text output to fax	●	○	○	●	○	○	○
Directs printer graphics output to fax	○	○	○	●	○	○	○
Saves printer text output to file	●	●	○	●	○	○	○
Saves printer graphics output to file	○	●	○	●	○	○	○
Converts to/from:	.PCX, ASCII	.CUT, ASCII, *Windows*, *Windows Paint*	.PCX, .CUT, TIFF, OCR, ASCII, *WordStar*	.PCX, ASCII	.PCX, .CUT, ASCII	.PCX, .WKS, ASCII	.PCX, .CUT, .WKS, ASCII, *AutoCAD*, *PageMaker*, *PC Paint*, PostScript
Erasing after transmission	None	Manual	Automatic	Manual	Manual	Automatic	Manual
OTHER							
Compatible scanners	Princeton LS-300A, Panasonic, HP ScanJet, Canon IX-12	The Complete Hand Scanner	Canon IX-12, ShapeScan, HP ScanJet	Canon IX-12, Brook Trout IX-12	Canon IX-12, CompuScan's PCS PageReader	Panasonic RX505/506, Microtek LS	Datacopy Jet Reader, Datacopy 730
Generates letterhead	●	●	●	●	●	●	●
Generates custom fonts	●	○	○	●	●	●	○
Standard modem included	○	○	○	○	Optional	○	●

●—Yes ○—No

XaFax	Beyond Fax, Model SPC-1	EZ-Fax
$1,195	$1,199	$1,495
9,600, 7,200, 4,600, 2,400	9,600, 7,200, 4,800, 2,400	9,600, 7,200, 4,800, 2,400
●	●	○
○	○	○
●	○	○
○	○	●
225	999	999
●	○	●
○	○	●

●	●	●
○	●	○
○	● (graphics only)	○
○	○	●
○	○	○
○	○	●
○	○	○
None	None	.PCX, .CUT, .WKS, ASCII
Manual	Manual	Manual or automatic

OAZ Scanner	Microtek	Dest PC Scan 2010, 2020
●	●	○
○	○	○
●	●	Optional

filenames, you can easily overwrite an existing file. You can use Smartfax's DOS utilities to avoid conflicts, but they are limited. For example, you are prohibited from entering long character strings, which makes it impossible to copy a file from one subdirectory into another. A handy place to check your message files is the Smartfax log, which is conveniently parceled into In and Out logs.

Modem control is also limited. Dialing is blind, with no detection or correction for problematic line conditions. The modem has no built-in speaker, and there is no way to handle a direct connection.

LIMITATIONS Smartfax has no gray-scale control and no control over resolution once the document has been scanned in or created and stored. Most documents will transmit in normal (100- by 200-pixel) resolution, and scanned-in documents can have high (200- by 200-pixel) resolution. My conversion of *PC Paintbrush* files to Smartfax worked, but the result was not a straight 1:1 conversion. American Data Technology is in the process of revamping the conversion program.

When Smartfax is in background mode, messages get stored in the same spooler used to queue messages for the printer. When a message comes in during background operation, the computer emits three shrill beeps and the keyboard locks up. Control returns to you only after the message is received. Documents stored in the spooler must be converted for fax format via a utility. The utility clears the spooler when it's completed, which can cause conflicts if you're using the spooler for printing operations as well.

Smartfax comes with a simple, straightforward graphics editor that emphasizes edit and block moves. There are no line-drawing tools, but you can flip and rotate graphic images, cut and paste, and change the font size of the display.

Like so many of the boards we tested, Smartfax is almost—but not quite—ready for action. To install the program, your hard disk must be "C:"; your floppy, "A:". You are also asked to supply the date and time every time you activate the program.

The manual could be bound better; mine quickly fell apart at the seams. And nowhere in this otherwise reasonable document is there a mention of the company's address or phone number. Also, some of my screen redraws (especially when I was printing a document) were so slow that the program was inoperable, even in foreground mode. Frequently my pull-down menus would break up on-screen. Sometimes my numeric keypad worked; at other times I needed to use the separate arrow keys.

Smartfax is particularly nice for international transmissions. Its difficulties are symptomatic of an infant program that has potential. As with many other boards we reviewed, we look forward to its next release.—**Robin Raskin**

BROOK TROUT TECHNOLOGY INC.

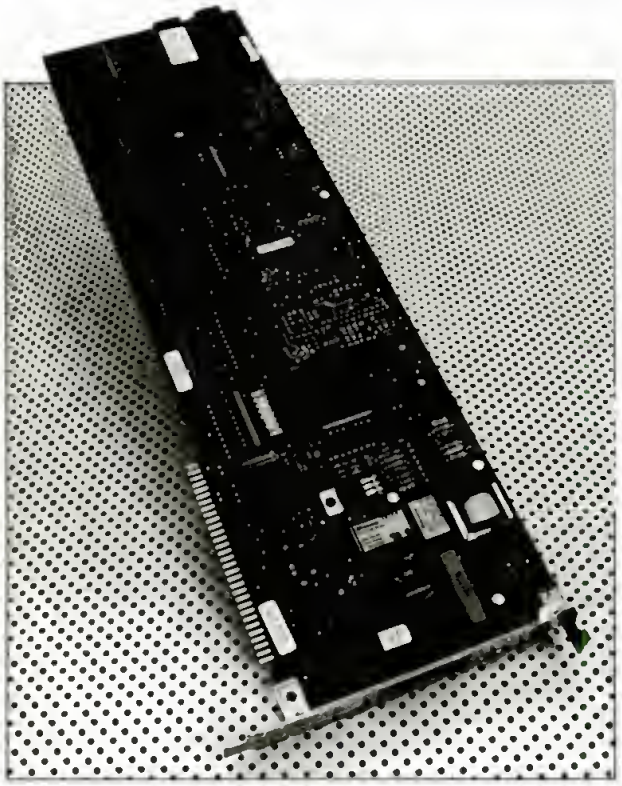
Fax Mail 96

Brook Trout Technology's Fax Mail 96 uses distribution lists and stored letterheads and signatures. In general, it has better print quality than that received from fax machines.

There are three versions of Fax Mail: models 24, 48, and 96. The only differences among them are speed and price; they operate at 2,400, 4,800, and 9,600 bits per second and sell for $595, $795, and $995, respectively. The Fax Mail software sends and receives standard fax Group-3 format documents and also converts ASCII and *PC Paintbrush* .PCX files. It is sold with a full-length interface card, phone cord, software on three disks, and a 95-page user manual.

Installation and configuration are relatively easy. The instructions for board installation are complete and clearly written, with explanatory line drawings. All software installation and configuration steps are explained both in the manual and on the computer screen.

The Fax Mail is entirely menu driven, using *1-2-3*–like hierarchical, horizontal moving-bar menus with second-line command definitions. The variety and arrangement of the commands are logical. The manual's tutorial demonstrates basic features with keystroke-by-keystroke explanations that will be reassuring to beginning



Brook Trout Technology sells three different versions of its Fax Mail 96. They are the same except for speed and price. Model 24 operates at 2,400 bps and sells for $595. Model 48 operates at 4,800 bps and sells for $795. Model 96 operates at 9,600 bps and sells for $995.

users but tedious to the more experienced. The manual picks up the pace for Fax Mail's more-advanced features. There is no quick reference card and little on-line help. Neither is really necessary, but an index in the manual would be helpful.

RECEIVING AND SENDING Once loaded, Fax Mail 96 receives incoming files unattended in foreground or background mode. It can run directly from the DOS command line with either single or batch commands.

■ We like the way the Fax Mail 96 gives you a choice of speeds at various prices.

You can send faxes received from other fax machines, scanners, ASCII files, and *PC Paintbrush* .PCX files. You can convert files to fax format either at the time of transmission or as a separate step to be sent later. You can also use the Fax Mail's printer capture mode to convert information being sent to a printer from standard Epson format to a fax format file.

Letterheads and signatures can be stored and added to outgoing files. The Fax Mail lets you choose a default letterhead or assign a particular letterhead to a given file. It also includes a minimal text editor so that you can create and assemble all the parts of a fax communication within the Fax Mail itself—an especially convenient facility.

Received faxes can be displayed, rescaled, flipped upside down (especially helpful if they came in inverted), and cropped through a process Brook Trout prefers to call "chopping." Even if you don't have a scanner or a regular fax machine, you can have someone else send you a letter on your letterhead with your signature, or perhaps with several signatures of people in your company, and then chop the various components of the received document apart to be used later with outgoing faxes.

Faxes can be sent immediately or scheduled for later transmission. A phone number feature lets you store single or multiple numbers and build distribution lists. You can also display and print logs of fax activity.

The Fax Mail worked fine with other equipment in our tests, including a Canon IX-12 scanner and an HP LaserJet Series II, although Brook Trout's own IX-12–driven scanner is the only one that the Fax Mail supports.

OFF-THE-RECORD FEATURES Oddly, the Fax Mail's file conversion routine expands the aspect ratio of *PC Paintbrush* files to twice as large as the original. The output can be readjusted with a nondocumented DOS-command-line parameter, but that shouldn't be necessary. Brook Trout's support staff were knowledgeable and helpful when we asked about the problem. The *PC Paintbrush* conversion default, they told us, is to be changed in a later version, which should be on the market by the time you read this.

You also have to rely on nondocumented commands to convert ASCII and *PC Paintbrush* files to G3 format if you want them in high-resolution mode. Hard-copy output of those files in a low resolution isn't very good. The ability to change resolution within the program's menu structure is another program change on the way.

The Fax Mail 96's numerous document-preparation features make it particularly convenient for those who want to create and fax correspondence directly from the computer. But its reliance on undocu-

PC MAGAZINE FACT FILE

Fax Mail 96
Brook Trout Technology Inc.
110 Cedar St.
Wellesley Hills, MA 02181
(617) 235-3026
List Price: 2,400 bps, $595; 4,800 bps, $795; 9,600 bps, $995.
Requires: 256K RAM; PC/XT/AT or compatible; hard disk; EGA, CGA, or Hercules video card; DOS 2.0 or later.
In Short: This board's reliance on undocumented commands to adjust aspect ratio and to convert documents to Group-3 format is annoying. Nonetheless, with three versions offering different speeds at different prices, it should fit into any budget.

CIRCLE **651** ON READER SERVICE CARD



Photo of Franklin Delano Roosevelt courtesy of WWAP.

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CIRCLE 218 ON READER SERVICE CARD

mented commands for advanced features is annoying. Still, we like the way the Fax Mail gives you a choice of speeds at various prices, all under $1,000. If you want to trade high speed for lower costs, the Fax Mail lets you do it.—**Bruce Brown**

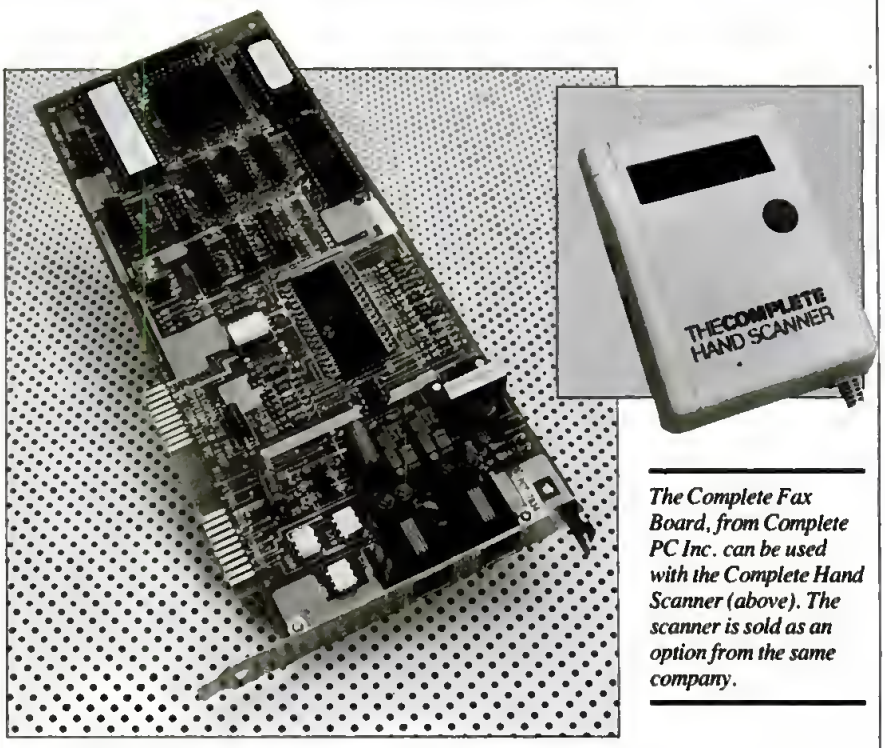
COMPLETE PC INC.

Complete Fax Board

The Complete Fax Board, a $499 fax board from Complete PC, offers a little of everything for the PC user who needs everyday fax capabilities. The software allows you to create fax documents from various file formats as well as to send and receive faxes in background mode, all from a function-key-driven menu system.

The Complete Fax Board (CFax) can continuously poll for incoming documents, and outgoing faxes can either be sent immediately or set to transmit at specified times. The CFax software allows you to create, view, print, send, and receive facsimiles, set up a dialing directory of often-used fax numbers, modify the system parameters (I/O address, graphics adapter type, printer, and dialing type), and monitor the status of background activities.

The three-quarter-length CFax board is virtually ready to work the minute you snap it in. If you have another expansion board in your PC that conflicts with the I/O address of the CFax board, you can reset the address using DIP switches or reset it through the configuration menu. An INSTALLF.EXE program copies the CFax software from the three distribution disks into a directory on your hard disk called FAX and adds the necessary information to your AUTOEXEC.BAT and CONFIG.SYS files. During installation, the software can be configured to load into memory automatically each time you start up your computer. The board has two female phone connectors, one labeled "line" for fax transmissions and the other labeled as a phone line. The CFax also includes its own telephone cord.



The Complete Fax Board, from Complete PC Inc. can be used with the Complete Hand Scanner (above). The scanner is sold as an option from the same company.

MENU OPERATION From the CFax menu, you can easily access all fax operations by pressing function keys. You can also issue various commands from DOS to convert, display, print, scan, and send fax files. The documentation is a bit thin, but a "menu-sensitive" on-line help facility makes up for it. You can access multiple-page help screens using the F1 key from just about anywhere in the CFax menus.

The CFax software can convert files to and from *PC Paintbrush Plus* and *Dr. Halo*. It can also convert from ASCII, *Microsoft Windows*, and *Microsoft Windows Paint* formats to fax format. File conversions can be performed only in the foreground and must be done as a separate step before transmitting fax documents. However, a group of files can be converted to fax format using a single command. Fax documents can be created using either fine resolution (196 dots per inch vertical) or standard resolution (98 dpi vertical).

Faxes can be displayed in seven different aspect ratios, in normal or reverse video, and can be rotated 90 degrees counterclockwise one or more times. You can easily batch fax documents together and identify an overlay document as a transparency so that the originals and the transparency are shown together—something you would do to attach a logo or letterhead, for example. You can also make the overlay solid so that it blanks out parts of the originals. If you merge a standard-resolution document with a fine-resolution document, CFax automatically upgrades the standard one to fine resolution before merging the two files.

The only scanner that worked with CFax when this review was written was the Hand Scanner from Complete PC, but that should have changed by the time you read this. A representative from the firm said the company was due to release a driver for the HP ScanJet this spring. The Hand Scanner looks like a large mouse and requires a separate slot in your PC. Be-

FACT FILE

Complete Fax Board
Complete PC Inc.
521 Cottonwood Dr.
Milpitas, CA 95035
(408) 434-0145
List Price: $499
Requires: 384K RAM; PC/XT/AT or compatible; hard disk; EGA, CGA, or Hercules video card; DOS 2.0 or later.
In Short: One of the less expensive units we tested, this board lacks a graphics editor, 9,600-bps support, and Hayes modem capabilities, but remains a good value for its price.

CIRCLE 650 ON READER SERVICE CARD

ANNOUNCING ROLLCALL

the "instant access" address system that puts your old card file in its place.



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A GREAT BUY: RollCall costs only $49.95. Amazing when you consider that we include a 3-1/2" diskette in addition to a 5-1/4" diskette, so you can conveniently put RollCall on any system. And we offer you TOLL-FREE hotline support *absolutely free of charge.*

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CIRCLE 384 ON READER SERVICE CARD

ROLLCALL™
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Name_____

Address_____

City_____ State_____ Zip_____

Phone # (in case we have a question about your order):_____

CHECK ONE:

☐ Check enclosed (payable to Qandu Computing).

☐ Charge my:

☐ VISA ☐ MasterCard

Acct. #_____

Expiration Date_____

Signature_____

PCM6/28/88

Mail to: Qandu Computing, Inc.
12040 South Lakes Drive
Reston, VA 22091.

QANDU COMPUTING INC

Software for Mere Mortals

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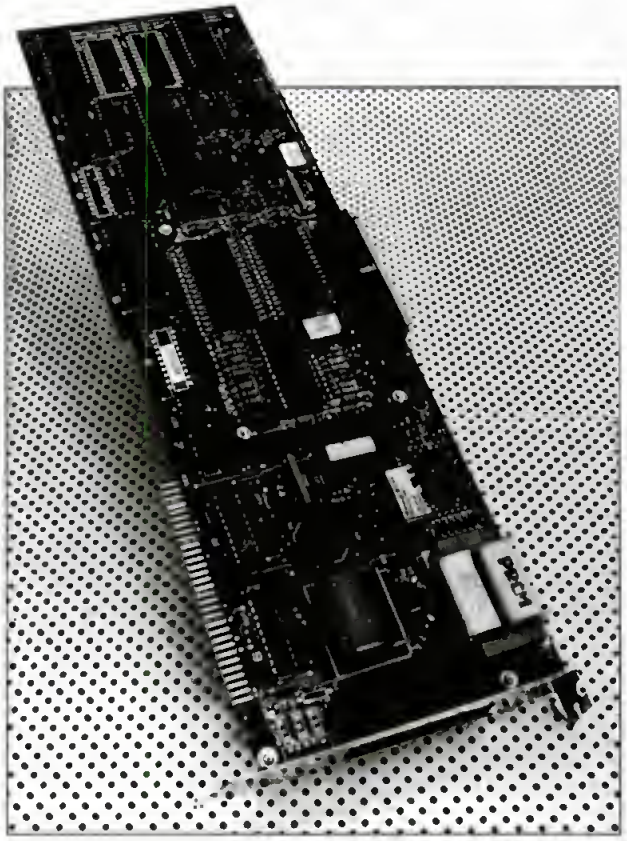
cause it is 3½ inches wide, it is ideal for scanning logos, letterhead, and signatures. The Hand Scanner comes with Soft Stationery software, which lets you easily combine fax documents with scanned-in letterhead or signature images.

TRANSMISSION Faxes can be sent immediately, or they can be entered into an outgoing queue and sent at a scheduled date and time. To let you know what's happening in the background, CFax beeps once and displays a "Fax" message in the bottom-right-hand corner of the screen when faxes are received.

CFax operates at 4,800 bits per second and can step down to 2,400 bps if needed. It can communicate only with other Group 3 fax machines, but in our lab tests, the CFax had a slight problem with the Canon Faxphone 20. When text documents were sent to the Faxphone, the first character of each line was stripped. This problem reportedly would not occur with a more recent Faxphone 20, and did not occur when the same document was sent to a Ricoh 60.

The Complete Fax Board is easy to install and use. It produces high-quality text and image fax files and is suitable for sending and receiving documents. At the same time, it lacks advanced fax features such as a graphics editor, Hayes-compatible modem capabilities, and the ability to transmit faxes at 9,600 bps or transmit gray-scale images (photos). For everyday facsimile transmission, however, the Complete Fax Board offers a lot for the money.

—Greg Alwang



MicroFax from Datacopy will consume a full-size motherboard slot. Datacopy, however, compensates you for the space the board requires: MicroFax is equipped with a 9,600-bps modem that can be stepped down to 1,200 bps and used as a Hayes-compatible data modem.

DATACOPY CORP.

MicroFax

Datacopy Corp.'s MicroFax is a top-quality PC fax board priced at $1,195. You can buy it with the Datacopy Jet Reader and a scanner interface board, in a combination called the Jet Fax, for $2,195. It sends beautiful output to both fax machines and laser printers. You can pay less for a fax board, but you probably won't find one that produces cleaner copy.

The MicroFax comes with a full-length fax board, three program disks, a telephone cord, a user manual, and a quick reference card. The board's 9,600-bit-per-second modem for fax reception and transmission can also be stepped down and used as a Hayes-compatible 1,200-bps data modem, saving a slot in your computer.

The MicroFax board has somewhat more stringent requirements than some of the other boards tested. It demands at least 384K, a full-size motherboard slot, and at least a 10MB hard disk drive. In practice, that shouldn't pose a problem to most users. To set it up, you plug the board into a full-length slot, put Disk 1 into drive A: on your computer and, from the C> prompt, issue the hilarious command A:LOADUFAX.

The manual has a QuickStart section that promises to help a new user send the first fax within 5 minutes. While the MicroFax menus look a bit dated, they are clear and include necessary help information. Whenever options are available, a pop-up menu appears in the middle of the screen. A fairly complete tutorial is included in the manual, along with a reasonable amount of reference material.

You can set up a telephone directory, schedule fax transmissions for any date and time you wish, and set the delay and the number of retries when the called number is busy. You can also view and print transaction logs and calling schedules.

SOFTWARE SPECIFICS One of MicroFax's special features is that the program can convert both to and from many

PC MAGAZINE FACT FILE

MicroFax
Datacopy Corp.
1215 TerraBella Ave.
Mountain View, CA 94043
(415) 965-7900
List Price: $1,195
Requires: 512K RAM; PC/XT/AT or compatible; hard disk; EGA, CGA, or Hercules video card; 2.0 DOS or later.
In Short: The output of this board was among the best in our tests. But its lack of hi-resolution and gray-scale modes and its inability to send files with compressed type are considerable drawbacks in a board that bears this price tag.

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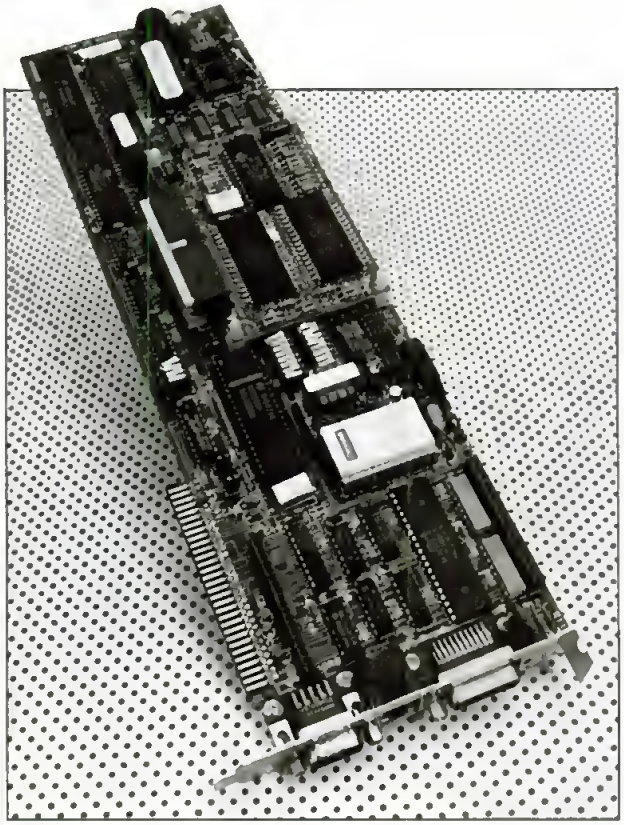
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graphics formats, including *PC Paintbrush, Dr. Halo, Lotus 1-2-3*, PIC files, *PC Paint, AutoCAD*, and TIFF files. It can also read *PostScript* files, although it cannot convert files to *PostScript* format.

Once the software is loaded, it works totally in the background. MicroFax reserves 3.2K of RAM solely to monitor input and output so that nothing interferes with foreground operation. At one point in the testing, MicroFax was sending a previously received fax to a laser printer at the same time it was receiving another from a fax machine. The printing operation was slowed down a bit, but both operations were completed perfectly.

The MicroFax software works well but lacks several features available from competitors. There is no high-resolution mode, no gray scale for transmitting photographs, and no font selection or control. You cannot select a compressed mode to transmit 132-column text to fit on a normal 8½-inch-wide fax sheet. Even more limiting is the lack of a printer output capture mode for immediate or later fax transmission, although you can convert a screen dump. All of the missing features are reportedly in a new version of the product released too late to be tested for this review.

MicroFax combines adequate software with a terrific-quality output. The data modem capability is the frosting on a very rich cake. While the software tested was missing some features, the new version should take care of that concern. When combined with one of Datacopy's scanners, this is a hard package to beat.—**Bruce Brown**



EZ-Fax, from Dest Corp., like Datacopy's MicroFax, is a full-length board that makes amends for the space it requires. EZ-Fax has an extra serial port, addressable to either COM1 or COM2. It also is equipped with a modular phone jack and a cable with a two-line T connector.

DEST CORP.

EZ-Fax

The EZ-Fax board was developed and marketed by Gulfstream Micro Systems until August 1987, when the company was purchased by Dest, the scanner people. Following the acquisition, Dest stopped selling its own Facsimile Pac fax product to market the EZ-Fax board with its line of scanners.

The EZ-Fax is a full-length plug-in card that is reasonably well built, although the samples submitted for our tests had several hand-wired jumpers. A serial port is included as standard, a handy feature that may save you a slot. You can address the serial port to either COM1 or COM2, or you can disable it.

There's only one modular phone jack and, while there's no separate jack for a phone, Dest includes a modular cable with a two-line T connector at one end that's functionally just as good. You can add two optional extras to the board: a Data Encryption Standard encode/decode chip ($195) and a Hayes-compatible 300/1,200-bit-per-second modem (the 9,600-bps fax modem on the board isn't usable for normal telecommunications). Only Dest's PC Scan scanner can be used with the EZ-Fax. A special connector on the EZ-Fax's backplane connects directly to the scanner, which uses an SCSI port.

THE INSTALLATION CHALLENGE

Installation is easy if you can use the defaults that the board is shipped with. If not, you should understand interrupts, I/O addresses, DMA, and similar factors to set the jumpers and DIP switches. In our tests the boards proved difficult to seat. Dest recommends that you have your dealer install the board.

The software installs automatically, but it modifies your CONFIG.SYS and AUTOEXEC.BAT files. The program tells you of its intent to do this, and you have ample opportunity to handle things manually if you prefer.

While all the fax functions operated as expected, getting the board to work with Dest's scanner was not so easy. After numerous phone calls to Dest's tech support,

PC MAGAZINE FACT FILE

EZ-Fax
Dest Corp.
1200 Cadillac Ct.
Milpitas, CA 95035
(408) 946-7100
List Price: $1,495
Requires: 640K RAM; PC/XT/AT or compatible or PS/2 Model 30; hard disk; EGA, CGA, or Hercules video card; DOS 2.0 or later.
In Short: A serial port on the board is a nice plus, but compatibility with Dest's own scanner was not well documented in this version. Dealer installation is recommended.

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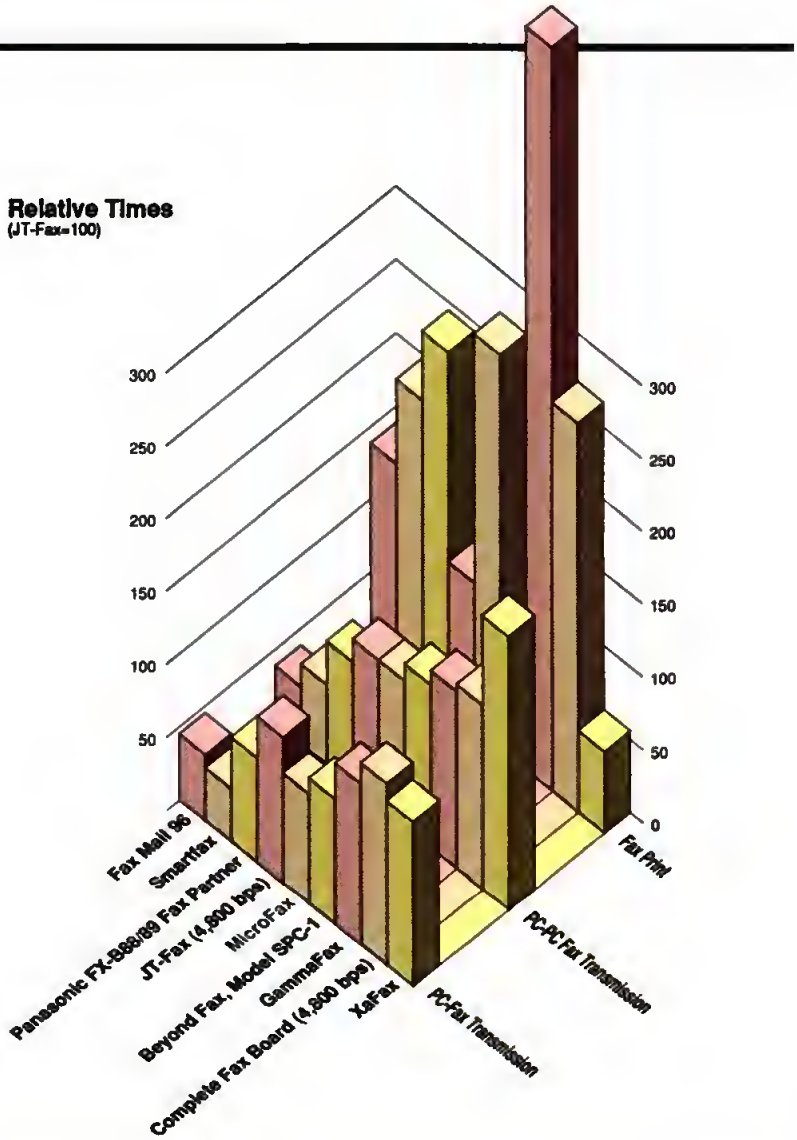
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Benchmark Tests: Fax Systems

While PC Labs' originel intention was to separate 9,600-bit-per-second end 4,800-bps fax boards for testing, evaluation of the products revealed that many factors, such as phone line quality, distance, and internal memory and processor configurations, have e greater influence on transmission speed than baud rate. Of the eight 9,600-bps models, only the Fax Mail 96 and Smartfax were faster then the 77-second performance echieved on our two transmission tests by a standelone fax machine, the Canon FaxPhone 20.

Since printouts of faxes received are a desirable feeture, print times are also important. The XaFax's slow transmission times belie its fast printing speeds, bolstered by its on-board RAM and own 80188 processor. The JT-Fax is also a speedy printer and offers respectable transmission times despite its 4,800-bps rating—which means that it is not only the least expensive board tested, but also the best value.

The EZ-Fax was able to execute all test procedures, but it runs in the background and does not indicate the beginning or end of operations, making timings impossible. Also, while the PC-Fax Transmission benchmark test transferred the test files of most packages to the FaxPhone 20, some boarda would not handshake properly with this product; these were insteed timed using the Ricoh FAX60. At press time, we had not satisfactorily resolved this problem with Canon.



Performance Times
(Times given in seconds)

	PC-Fax Tranamiasion	PC-PC Fax Tranamission	Fax Print
Fax Mail 96	50	40	139
Smartfax	40	56	197
Panasonic FX-B88/89 Fax Partner	79	87	244
JT-Fax (4,800 bps)	110	103	100
MicroFax	83	103	271
Beyond Fax, Model SPC-1	95	115	N/A
GammaFax	122	125	510
Complete Fax Board (4,800 bps)	138	130	267
XaFax	125	193	56

N/A—Not applicable; printing to the HP LaserJet was not supported in the release tested

The **PC-Fax Tranamiasion** benchmark test times the transmission (without printing) of e 2-page letter in an ASCII text file. Each product is timed on an 8-MHz IBM PC AT, transferring the test file to a standalone fax machine.

The **PC-PC Fax Tranamiasion** benchmark test times each package as it transfers the same file to an identically configured AT with the same model fax board. This test lets the package benefit from any proprietary features that might override the standalone fax standard.

The **Fax Print** benchmark test times the printing of the 2-page test letter received in the fax transmission benchmark tests. An HP LaserJet II with 4MB of RAM is used for this test, and timing is measured from the issue of the print command to the completion of printing.

Fax output, when transmitted to a standard fax machine from a PC, may look better than what you get when you send a document from one standard fax machine to another. The reason is that standard fax machines scan the document before sending it over the phone line and some resolution is lost in the scanning process. PC fax skips the scanning process because it sends the document file directly from your computer. The resolution of all faxed output conforms to the Group 3 standard of 200 dots per inch.

Note the degradation in the image of a text file printed on the HP LaserJet II and sent from one fax machine to another, compared with the quality of text files sent to a fax machine from the PC fax packages reviewed here.

Nevertheless, how well you like the output produced by a PC fax package will depend on the fonts the package uses. Those we tested have their own fonts, and the user has little control over their appearance. The font used by the Fax Mail 96 most closely resembles the LaserJet's Courier typeface; unlike the other PC fax packages, it does not put a slash through the zero. All except the Panasonic FX-B88/89 Fax Partner and the Smartfax use a serif font.

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Panasonic FX-B88/89 Fax Partner

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the company sent a replacement scanner—which also wouldn't work with the board—occasioning more phone calls. Only then did a technician discover that an installation setting needed to work with the fax board was not in the scanner's printed manual. Although there was information on the change in an on-screen help box, you would have had to be told to ask for it. (We verified the "correctness" of our original installation with Dest's tech support several times.) We hope that the next release will include adequate discussion of the settings.

SOFTWARE The primary fax software operates completely in the background and is essentially invisible during normal DOS operations. It accepts incoming faxes, converts them for printing or display, and even prints them if you wish—all without any intervention from you.

■ The EZ-Fax software is menu driven and easy to understand and use. The program maintains a log of all transactions.

There are a couple of caveats. You can lose data if you use DOS's CHKDSK, DISKCOMP, or FORMAT, and you should not use hard disk utilities, such as *The Norton Utilities* or *PC Tools*, which directly access the hard disk while the EZ-Fax is running in the background. There is also no provision to disable the background manager once it's installed. If you've chosen the automatic invocation of the background manager (as most users would), Dest's only suggestion is to reboot with a plain DOS floppy!

The EZ-Fax software is menu driven and easy to understand and use. The program maintains a log of all transactions, much as a standalone fax machine does. Once a fax is received, the program converts it for printing and sends it to your printer if you've chosen automatic printing. As with most of the fax boards tested, the conversion and printing process is slow.

The program must perform another slow conversion if you want a viewable format on-screen. You can pan over the surface of the image sheet at one of the two magnifications provided. But even the "small" views don't show the entire width of a standard page—at least not on our EGA test screens.

The program keeps a simple database of fax numbers, each with an ID, the phone number, and a brief description, which is more than adequate. You need only specify the file to send, its destination, and when you want it sent (the software can schedule almost any transmission at your convenience or when the rates are lower.) The EZ-Fax doesn't handle distribution lists, although you can send multiple messages if you know how to create and use DOS batch files.

FEED ME Sending scanned documents is almost as easy. The software prompts you to insert your originals into the scanner. Unfortunately, the Dest PC Scan is a single-sheet device, so you can't stack originals, as you can with most standalone fax machines, and you have only 3 seconds to feed the second and subsequent sheets manually.

You can also transmit PC graphics images in either *PC Paintbrush* or *Dr. Halo* format or capture output from any program that can print to an Epson FX-80. Once you've obtained a graphics file, you must convert it to fax format with a utility program that must be run directly from DOS. The process is slow and much less obvious than if the conversions had been built into the EZ-Fax menu system.

Aside from our difficulties in getting the board to work with the scanner, we found the system to be bulletproof: accessing an empty drive or issuing a Ctrl-S during receipt of incoming faxes caused no problems at all. Rebooting during an incoming fax lost the message, but this isn't surprising.

Aspects of the operation could be better integrated. We'd like to see the capacity for handling gray scales, automatic distri-



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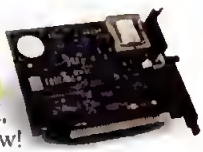
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CIRCLE 313 ON READER SERVICE CARD

bution lists, and several other niceties built into the menu-driven software system, and the documentation should be updated and improved. Dest tells us that a new release addressing these concerns is scheduled to appear within the next few months.
—Glenn A. Hart

GAMMALINK SYNCHRONOUS COMMUNICATIONS

GammaFax

The GammaFax board, from GammaLink Synchronous Communications, was the first PC fax board to appear on the market. With its powerful script language and its capability to interface with high-level programming languages, it remains one of the most powerful.

It is also one of the most intimidating to novice users—for exactly the same reason. Programmers and power users will love the flexibility it offers. Software can be customized and operation simplified to a few keystrokes.

GammaLink markets a number of versions of the product, including three that sell for $995—GammaFax, the board that we tested; GammaFax MC for the PS/2; and a short board called GammaFax US. The GammaFax Plus board, with a 1,200-bits-per-second modem, lists for $1,195, and CAD-Fax, which includes a modem and the capability of handling *AutoCAD* and HPGL files, sells for $1,995.

All the program's functions are available directly through commands that you can execute from the DOS prompt, which means that you can completely automate GammaFax with DOS batch files.

This feature should prove very useful for anyone who needs to perform the same multistep task regularly—such as generating a series of invoices with another program and then faxing them to different locations at a specific time every day. Your batch file can contain a list of files to send, a list of phone numbers to send them to, and the time to begin the transmission.

■ GammaFax is intimidating to novice users, but programmers and power users will love its flexibility.

COMMAND LANGUAGE There's also a menu system that makes it easier to do such things as sending, receiving, printing, or displaying files. Unfortunately,

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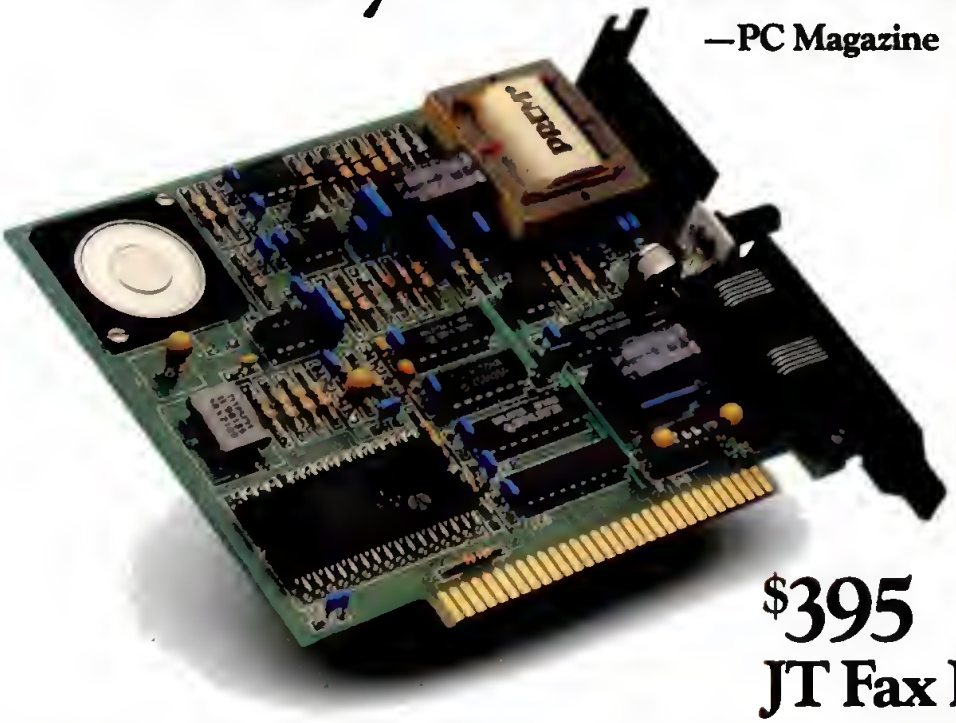
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Fax To Go



If you're on the go, consider the JT Fax Portable. It slips into your pocket and plugs into any MS DOS portable's serial port to let you fax from wherever you are.

Common Interface

The JT Fax half card internal shares a common software interface with the JT Fax Portable and even the lightning fast JT Fax 9600, the lowest-priced 9600-baud adapter. With the LAN operating software, the JT Fax 9600 is perfect for shared use on a network.

So you can support dozens of word processing, spreadsheet, and graphics packages while sharing the same interface with others in your organization.

Unique Technical Approach

JT Fax was nominated for PC Magazine's Technical Excellence Award. And in selecting JT Fax Editor's Choice, PC Magazine said "An innovative approach is the key to the success of JT Fax: it converts documents on the fly while transmitting them at half the speed of the other units. This approach keeps its cost down and saves file storage space, without degrading image quality and without delaying typical transmission times appreciably."

TECHNICAL EXCELLENCE PC MAGAZINE

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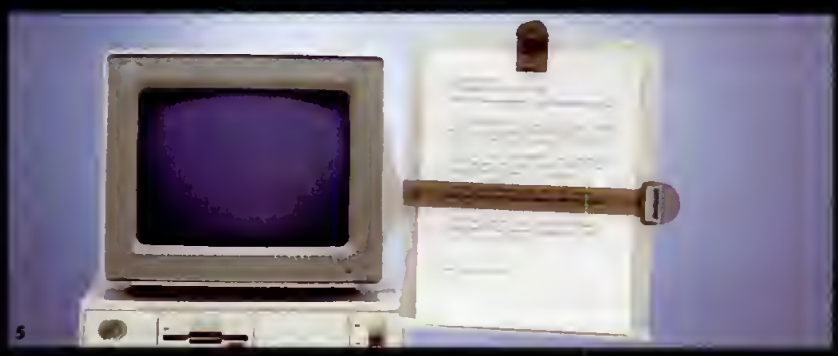




When you got your PC, it was love at first sight. How did it ever come to this? It's taken over your entire desktop. Your screen has disappeared beneath a thick layer of dust. The noise from your printer is driving you crazy. You just can't go on like this...

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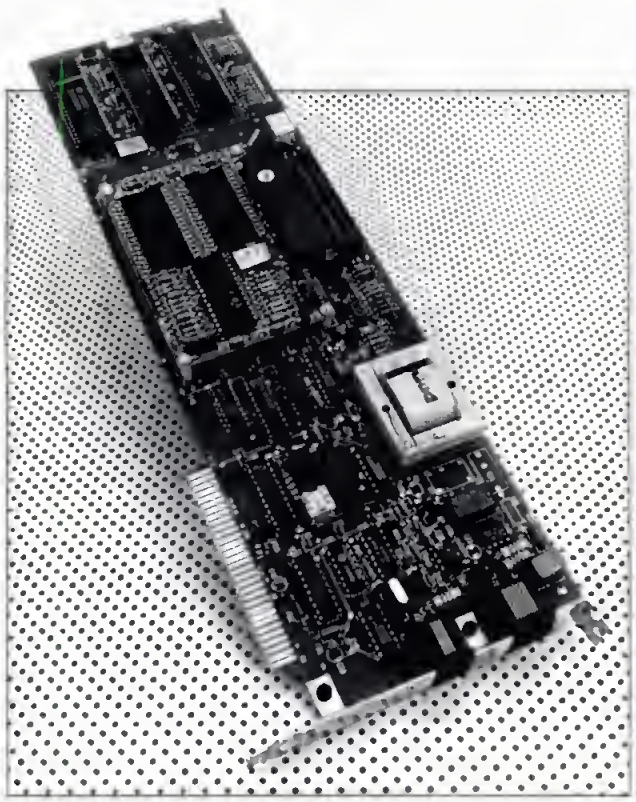
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CIRCLE 272 ON READER SERVICE CARD



GammaFax, from Gammalink Synchronous Communications, is the progenitor of PC fax systems. GammaFax, shown here, is for use with PC compatibles. GammaLink also markets a version for the PS/2, a short board, a board equipped with a 1,200-bps modem, and a system designed to send CAD files.

though, in the version of GammaFax that we tested, most of the product's other features are accessible only through the command language. To execute commands, you must hit the Esc key, which temporarily brings up the DOS prompt, then type in the appropriate command string.

Nevertheless, even for the power user, the arcane nature of the command language and the poor documentation conspire to make the version of GammaFax we tested a very difficult product to master. GammaLink is aware of these problems and claims that in its next release—which should be available by the time you read this—GammaFax will give you access to all its functions through the menus as well as through the command language. The company also promises a completely rewritten manual.

Before you can transmit a file with GammaFax, you must go through a separate conversion step to change it to a proprietary fax format, specifying either high or low resolution. The conversion utility also lets you extract parts of a file, append one file to another, or turn an image upside down. If you wish to append a graphics file (say a logo) to an ASCII text file, you must use a word processor to insert a special code at the beginning of the text file. This method may be a little awkward, but it's less cumbersome than some others we've seen.

USING A SCANNER You have the option of using GammaFax in conjunction with the Canon IX-12 scanner or the PCS PageReader scanner from CompuScan. This lets your computer function as a fax machine, although scanning and transmission are two separate steps here. Unfortunately, GammaFax can't take advantage of the Canon scanner's gray-scale feature.

You have a good range of dialing capabilities for transmitting your fax files. Although GammaFax won't recognize a busy signal or a voice answer, it will let you create distribution lists that specify how many redials to make for each phone number on the list before moving on to the next number.

GammaFax will receive transmissions in either foreground or background mode. It should be noted, though, that we could not get GammaFax to receive transmissions properly from our Canon Faxphone 20. (The problem was not with GammaFax but with our Faxphone; more recent models are truly Group 3–compatible and do work correctly with GammaFax.)

The quality of the images transmitted and received is quite good and compares well with standalone fax machines. The *PC Paintbrush* files we transmitted mapped pixel for pixel to the fax page, preserving the aspect ratio of the original.

GammaFax has an on-screen display mode that lets you view any fax format file, zoom in or out on it, and rotate it. Text in a high-resolution file is very readable on screen, but complex graphics or low-resolution text must be zoomed in on before they become clear. You can also print fax format files, which are easy and produce good results but tend to be very slow: it took us 8½ minutes to print 1½ pages of text with a logo in high-res mode.

GammaFax's powerful script language, good range of features, and high-quality output make it a product for technically oriented users who need something to handle demanding and complex fax tasks. Occasional users who don't want to invest large amounts of learning time will probably find this version of GammaFax more than they can handle. If, however, GammaLink lives up to its promises with the new release of GammaFax and produces a friendlier user interface and a better man-

PC MAGAZINE FACT FILE

GammaFax, Version 3.4A
GammaLink Synchronous Communications
2452 Embarcadero Way
Palo Alto, CA 94303
(415) 856-7421
List Price: GammaFax, GammaFax MC (for PS/2), GammaFax US (short board), $995 each; GammaFax Plus (with a 1,200-bps modem), $1,195; CAD-Fax (includes modem and capability to handle *AutoCAD* and HPGL files), $1,995.
Requires: 256K RAM (512K for background operation); PC/XT/AT or compatible; hard disk; EGA, CGA, VGA, Hercules, Genius, or Wyse 700 video card; DOS 2.0 or later
In Short: Confusing menus and documentation detract from the overall flexibility of this board. A powerful script language makes this a choice for power users who can customize operation for daily use by inexperienced users. Installation by a programmer is strongly recommended.

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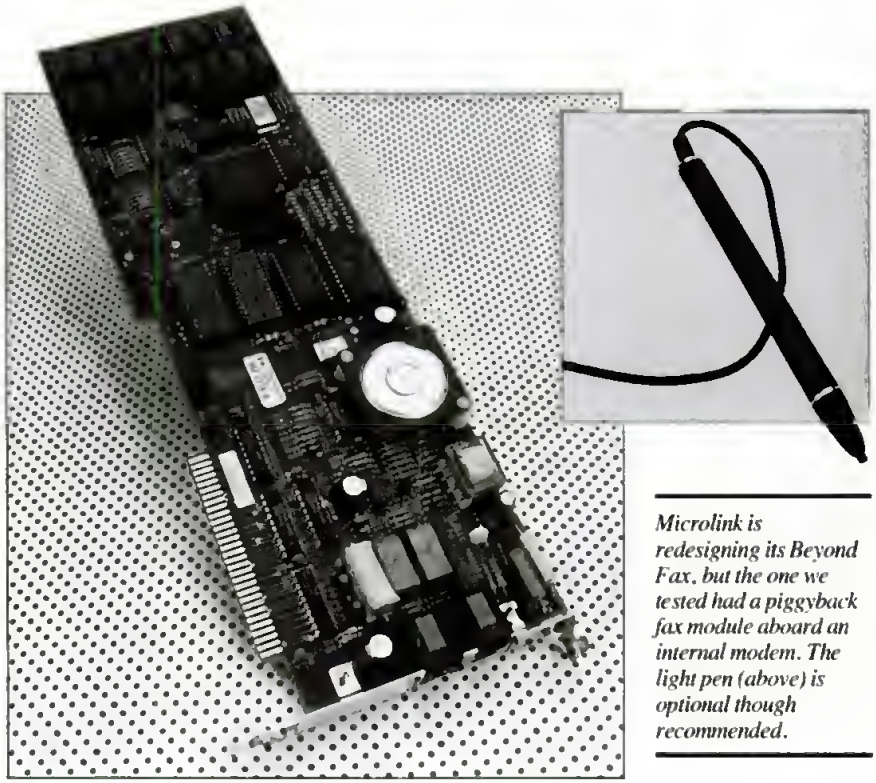
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ual, this product may end up in the running as a good general-purpose fax board as well.—**Rob Kendall**



Microlink is redesigning its Beyond Fax, but the one we tested had a piggyback fax module aboard an internal modem. The light pen (above) is optional though recommended.

MICROLINK INDUSTRIES LTD.

Beyond Fax, Model SPC-1

With its $1,199 Beyond Fax, Model SPC-1, Microlink has put together a grab bag of communications functions, including a rudimentary graphics package and word processor from which you can transmit the file on-screen in a single step. Another facility lets you transmit any DOS file at 9,600 bits per second. You even get a chess game that you can play with someone at the other end of the phone.

The SPC-1 board we tested included a piggyback FX96 fax module on an internal modem board. The piggyback module consumed an extra slot in our machine. However, the company has wisely decided to discontinue the separate fax module and will instead build the FX96 into a more streamlined single-slot version of the SPC-1 board.

To use Beyond Fax, you need either a Mouse Systems mouse or Microlink's light pen. We tested the product with the light pen, which Microlink considers the optimal input device. It's fun. You can draw pictures in graphics mode, but it gets a little awkward having to put the thing down to type in filenames between menu selections. Light pens are also notorious for their inaccuracy. Our drawing was slightly offset from the pen tip.

Installing the Beyond Fax software is not for the faint-hearted. You're required to write your own start-up batch file containing such arcana as commands that assign the SPC-1 board and the mouse to their respective COM ports. Then, when you start the program, you're greeted with a cryptic, undocumented error message. Don't worry, though: a call to the technical support service revealed that this error message was a normal part of hard disk installation. After you start the program and alter a setting in the initialization menu, it appears no more.

Once you're up and running, finding your way around the menus is generally simple, and the menu options are usually self-explanatory. This is fortunate, since the manual leaves much to be desired—an index, for example (though Microlink promises one in a future release).

CONVENIENT INTERFACE The user interface offers some nice conveniences, such as a phone directory from which you can select numbers for automatic dialing. Since the phone book file is stored in ASCII format, you can add to it from other programs. Another pop-up window shows you a log of all the files that were automatically received, including time and date. This window doubles as an entry screen for listing files that you wish to batch together for automatic transmission, letting you include a different phone number for each file. You can also specify that files be sent at a later date or time. It would be more convenient, however, if separate screens were provided for sending and receiving files. Another nice feature times the duration of your calls.

SOME LIMITATIONS You can display and scroll any fax format file on-screen. You're initially presented with an enlargement of the file, and you can zoom out on it, but you can't zoom back in. Another inconvenience is that the increments of reduction are annoyingly large. To view our ASCII test file on-screen required scrolling the image from side to side to read the end of each line; a further reduction of the file to fit it all on the screen rendered it illegible.

Beyond Fax has a number of other limi-

PC MAGAZINE FACT FILE

Beyond Fax, Model SPC-1
Microlink Industries Ltd.
4064 McConnell Dr.
Burnaby, B.C., Canada V5A3A8
(604) 420-0366
List Price: SPC-1, $1,199; LC96 short board (fax functions only), $499; light pen, $388.
Requires: 512K RAM, hard disk recommended; Mouse Systems mouse or Microlink light pen; EGA or CGA video card; DOS 2.0 or later.
In Short: A remote chess game makes this package especially curious, but it lacks features you'd expect at this price, such as the ability to import graphics files and direct support for scanners.

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tations as well. It cannot run in background mode, although Microlink says a TSR mode is forthcoming. It cannot import files from any standard graphics packages. You can transmit only graphics created with the built-in graphics function, which cannot produce professional-quality output. Beyond Fax will import ASCII files but can transmit them only in high resolution. There's no low-resolution option that could help reduce transmission times. Even high-resolution transmission, though, does not produce text as crisp as it could be.

According to Microlink, Beyond Fax can import files created by the Microtek scanner, although no scanner was supplied for our testing. The scanner cannot, however, be run directly from the Beyond Fax software.

The version of the Beyond Fax software that we received for testing did not support the HP LaserJet, so we could not run the PC Labs printing test on the board we reviewed. However, the board will support the LaserJet in its next release.

Beyond Fax's odd mix of features may suit the needs of some users, but its lack of many significant capabilities makes it a rather weak contender in the fax market. To its credit, though, Microlink does seem intent on rectifying in future versions many of the shortcomings we found in the version we tested.

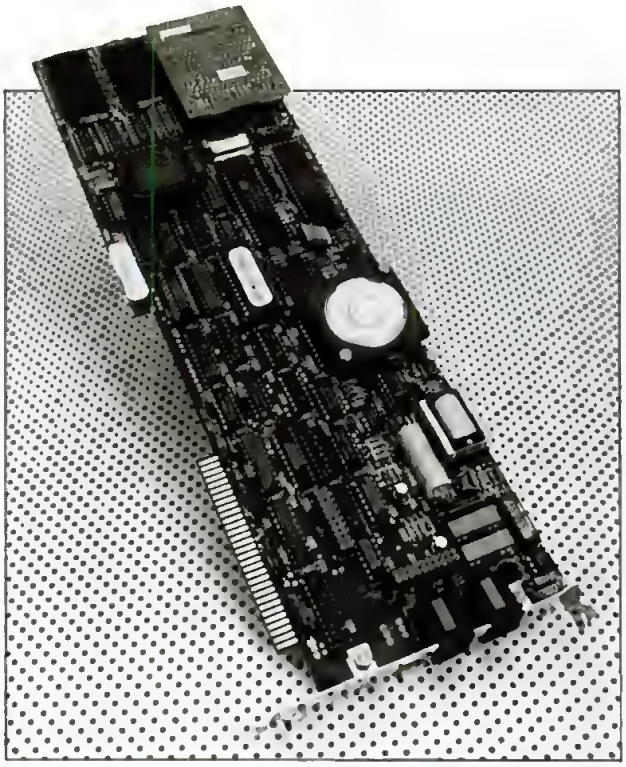
The company also plans to release a short-board version of Beyond Fax—the LC96—which will contain only the fax functions. At an attractive $499—well below the list price of most other fax boards—this scaled-down offspring may be worth a look for the budget-minded.

—Rob Kendall

OAZ COMMUNICATIONS

XaFax

The XaFax, from OAZ Communications, is a powerful PC fax board with the potential to rival many standalone fax machines. The fax board is feature-packed and adds many extra capabilities to your PC; however, it also has the powerful price of $1,195, and having the capability doesn't always mean that you can get the job done.



Priced at $1,195, XaFax, from OAZ Communications, is expensive. However, the board is equipped with an 80188 coprocessor, 512K of static RAM, a 1,200-bps Hayes-compatible data modem, and two phone jacks. Scanner and LAN interface cards are sold as options.

This is where the XaFax falls short.

Once it is loaded, the XaFax software stays memory resident and performs all fax communications in the background. The interface board comes with its own 80188 graphics coprocessor, 512K of static RAM, and a 1,200-bit-per-second Hayes-compatible modem. The coprocessor and the extra memory take most of the load off the PC and allow fax transmissions to take place almost independently from the host computer, with little interruption to foreground applications.

Installation of the full-length XaFax card is straightforward and is clearly illustrated in the manual. The board has two female phone jacks: one for data transmissions and one for the telephone. The jacks aren't labeled, however, so you have to check the manual to find out which is which. If you purchase a XaFax board with the scanner option, a piggyback board is added to the XaFax and the scanner interface is positioned just below the phone jacks. This saves a slot in your PC if you decide to purchase a scanner.

An Install program on the distribution disk copies the files onto the hard disk, and the system parameters are set from the main menu. The AUTOEXEC.BAT and CONFIG.SYS files are left alone, although the manual suggests adding the XaFax startup command to your AUTOEXEC file.

The version of XaFax we tested could convert only ASCII files to fax format and supported the OAZ-Scan scanner or the Canon IX-12 scanner (actually the same scanner). If you have a scanner, any image can be scanned into fax format. In the PC

PC MAGAZINE FACT FILE

XaFax
OAZ Communications
15032 Redhill Ave., Unit C
Tustin, CA 92680
(714) 259-0909
List Price: $1,195; optional scanner and LAN interface cards, $195.
Requires: 128K RAM; PC/XT/AT or compatible; EGA, CGA, or Hercules video card needed for displaying message; DOS 2.0 or later.
In Short: An 80188 coprocessor, 512K RAM, and modem capabilities on the board make this a board with a lot of potential. However, some menu choices in the version we tested were not yet implemented, and the capability of converting only ASCII files to fax format was limiting.

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Labs tests, XaFax had no problem with the ASCII file tests, and it sent very clear fax documents to the standalone fax machines.

The XaFax menus can be popped up from anywhere using a programmable hotkey combination. The menus are function key driven. Unfortunately, several choices in the menus were not yet implemented in the version tested. Also, the documentation didn't coincide with the version of the software that we tested. An OAZ Communications representative stated that the company will be supplying an updated version of the documentation with the next release of the software.

DOCUMENT DISPLAY Fax documents can be displayed in either single or double resolution (like zoom), in reverse video, or upside down. There is no graphics editor, but you can merge fax documents together. XaFax can handle fax documents up to 255 pages long. OAZ offers a separate font utility for $95 that enables you to modify and create fonts to be used in fax documents.

An address file can be created for frequently used fax numbers so that you have to enter only the name when sending a fax. A broadcast feature allows you to set up distribution lists for sending up to 30 fax messages to different locations. When you enter outgoing faxes into the queue, they can be scheduled to go immediately or at a later time.

■ The XaFax menus can be popped up from anywhere using a programmable hotkey combination. The menus are function key driven.

The XaFax board contains a separate fax modem and a 1,200-bps data modem; you toggle between them from the XaFax menus. The data modem saves you an extra slot and the trouble of having to dedicate a serial port to an external modem.

A more recent version, released after we tested boards for this review, was designed to include the following enhancements: conversion to and from .PCX and bit-mapped formats, ability to capture the current screen or printer output to a fax file, and additional scanner support. Also scheduled for release is a LAN version that will run on a dedicated workstation of a network and automatically poll a specified subdirectory for outgoing faxes.

For $1,195, the XaFax's price tag is a bit steep, but you pay for much more than merely being able to send faxes. The extra memory, coprocessor, data modem, and on-board scanner options make XaFax a board to watch in the future.

—Greg Alwang

Panasonic FX-B88/89 Fax Partner

Panasonic's FX-B88/89 Fax Partner is a clear indication of a maturing PC Fax genre. Priced at $999, the Fax Partner consists of an internal fax board with a built-in modem and some well-designed fax software. The software runs as a background application with a small (16K) memory-resident scheduler. A scanner is not a part of the package, but there's a very tight fit with the Panasonic 505 and 506 scanners (the Canon IX and Microtek LS300A are supported as well). With the exception of the lowly $5 phone cable that you'll need to go out and buy, you just pop in the board, use the automatic software installation and configuration programs, and you're ready to fax. The omission of a simple cable reminded me of childhood birthdays: plenty of hi-tech toys, no batteries.

To offer a communications equivalent of "WYSIWYG," Panasonic connects an LED indicator box to the fax board. The box sits atop the computer, and its Send and Receive indicators let you know what your fax is up to. Unfortunately, the utility of the LED box is somewhat diminished by its design. You see, the indicator box attaches to your computer with a magnetized strip. Panasonic's engineers should read a primer on the effects of magnetism and then opt for velcro fasteners.

The Fax software is divided into four basic areas: Sending, Receiving, Polling, and a General catch-all for utilities. The utilities manage file storing and naming, message tracking, the built-in phone book, and the Graphics Editor. The well-written manual is barely needed because the software is so straightforward.

For example, select Send a File from the main menu, and a list of all the files in the current directory appears on the screen. You then tag up to ten files for transmission, choose a phone number, assign a resolution for the transmission, and schedule the transmission either for now or for the future. If a scanner is attached, the software automatically supplies an additional Scan menu option. All selections are function key driven, with clear menu choices. The configuration parameters let you define headers, assign default directories, and specify a lead file for transmission. Reception of messages is equally logical; it includes both a manual mode, handy for switching between voice and data, and a default automatic receiving mode.

SIMPLE FAX You may send either ASCII, .PCX (*Paintbrush*) graphics files, or .DCX (*Paintbrush* files that are scanned in or saved in *Paintbrush* with the Save Document command). While this isn't the world's largest selection of document

FACT FILE

Panasonic FX-B88/89 Fax Partner
Panasonic Industrial Co.
Computer Products Div.
2 Panasonic Way
Secaucus, NJ 07094
(201) 392-6786
List Price: $999
Requires: 640K RAM; PC/XT/AT or compatible; hard disk; mouse recommended; EGA, CGA, Hercules, or Tecmar video card; DOS 3.0 or later.
In Short: Hardware installs easily; software is intuitive; the output is commendable. The "dropped into place" *PC Paintbrush Plus*, used as the Fax Software's graphics editor, however, doesn't fit the user interface of Panasonic's own software, and some menu choices were not implemented.

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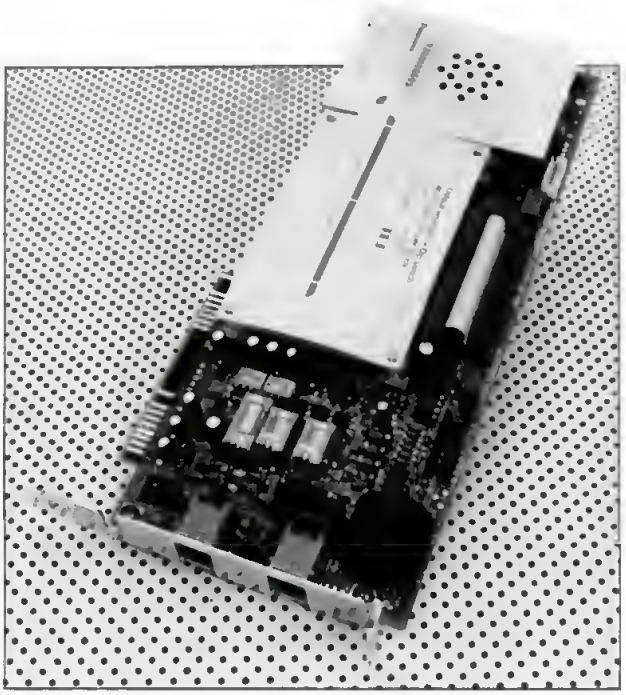
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CIRCLE 497 ON READER SERVICE CARD



The covering on the Panasonic FX-B88/89 Fax Partner protects the board from handling, as well as from touching other boards in your computer. The board can be snapped easily into place. However, Panasonic does not include a telephone cable.

types, it helps things stay nice and simple. Once a message is received and saved with the fax software, it may be accessed with the Graphics Editor.

Fax Partner's world is rosy until you enter the Graphics Editor. Panasonic uses Z-Soft's *PC Paintbrush Plus*, but the company's engineers did not modify the program to handle some necessary fax functions. While *Paintbrush*'s .PCX format makes a fine fax industry standard, the *Paintbrush* program itself has no business in the fax business. Here are a few of the reasons why: First, you must use a mouse with *PC Paintbrush*. Panasonic suggests that you can get by with using the keyboard as a pointing device, but listen to the voice of experience: you'll drive yourself crazy. The bottom line is that while the rest of the program is function key oriented, the user interface changes drastically when you enter the Graphics Editor.

Second, *PC Paintbrush* does not allow you to import ASCII text. So, for example, if you want to read in an ASCII file to combine it with a graphic logo, you can't. You need to type (or scan) text directly into *Paintbrush*. Third, *PC Paintbrush* cannot do a wildcard (*.*) file command. If you receive a message and save it with the filename PCMAG.LTR, for example, you will not be able to use *Paintbrush* to call that file from a directory listing (there is a renaming file utility available). Fourth, you cannot print multiple-page documents with *PC Paintbrush Plus;* you must print only one page at a time. So, when you receive a multipage message, you can print it on the fly, from the Receive/Print or Journal/Print command. But, once you save and store the message, you can never print it as a multipage message again. Incidentally, when you transmit multiple files they are received as a single multipage message, which makes multiple-page printing all the more necessary.

The fax software allowed me to specify either 400 by 400, 300 by 300, or 200 by 200 pixels as the resolution of the scanned image, even though fax transmissions are limited to 200 by 200 pixels or less. Since the images are bit-mapped pixel to pixel, when I transmitted with higher resolution,



the image was translated as wider than 8½ inches and was unacceptable. Panasonic should remove these inappropriate selections from the fax software.

Not to paint a one-sided picture, *PC Paintbrush* has some admirable capabilities including zooming, pattern fill, freehand and object drawing, flip and rotate capabilities, and a serious cut-and-paste facility. However, I've yet to see a fax user who sits down at a paint program to draw a message for transmission.

■ Panasonic FX-B88/89 Fax Partner's gray-scale control transmits photos with good, clean results.

GOOD CLEAN PHOTOS Overall, I was very happy with the quality of the transmissions. Gray-scale control (dithering) allowed me to transmit photos with good clean results. Surprisingly, I found that my transmissions from the hard copy via the scanner looked marginally better than when I transmitted directly from a file and then printed the output. One would think that there'd be less degradation from the file to the hard copy, but that wasn't the case. My laser-printed copy of a faxed photo had a cross-hatched look; my text files were not sharp. Panasonic suggested that the HP Series II printer that I used is not a directly supported device at this time. However, when I rerouted the fax output to an HP LaserJet I was equally unimpressed.

There are many highlights in this package. One is the background polling facilities. You can ready a set of messages for transmission when you are polled, or you can specify a time to poll a number from your phone book (either a group or an individual number). Another well-implemented feature is the Journal. Here messages, their arrival date and times, and the message size are recorded. Messages can be viewed, printed, or retransmitted from the Journal. The built-in phone book offers a convenient way to schedule transmissions to either an individual person or to a group. Modifications and additions to the book are made easily.

I thoroughly enjoyed using the Panasonic board. Indeed, the "fax" of the matter is that while most PC fax boards are, as we say at *PC Magazine*, "not ready for prime-time computing," the Panasonic is one of the better models in the fax pack. You can use this program with confidence, and that in itself is a great deal to be thankful for. **—Robin Raskin**

QUADRAM LIMITED PARTNERSHIP

JT-Fax

JT-Fax was good before. Now it's even better. When last reviewed in the January 26, 1988, issue ("Just the Fax"), JT-Fax was an Editor's Choice, earning high marks for price and performance. Since then, some software conflicts (especially with *Microsoft Word*) have been cleared up, and the JT-Fax, which, at $395, is priced less than the other boards in this review, is an even better bargain.

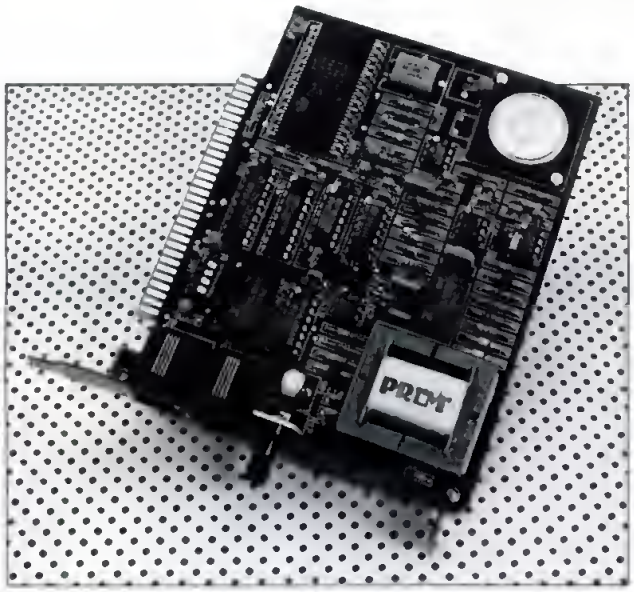
The only trade-off is its 4,800-bit-per-second communications rate (most other fax boards operate at 9,600 bps). If part of your reason for buying a fax board is high-speed data transmission, you'll have to look elsewhere. What you get with JT-Fax is a device with RAM-resident software. Both are easy to install and configure, are a snap to use, and often perform better than units three times the price.

JT-Fax comes in both internal and external models, with otherwise identical prices and features. The internal version



IN FACT ALMOST ANYTHING GOES FROM PAPER TO SCREEN AS FAST AS YOUR HAND CAN MOVE.





The JT-Fax, from Quadram, comes in both internal and external models. We tested the internal version, a half-length board that has two phone-line jacks and a volume control for the built-in speaker. It fits into any available slot.

we tested is a half-length board with two phone-line jacks and a volume control for the built-in speaker. You'll want to turn the sound down or even all the way off. When converting and transmitting files, JT-FAX sputters like a bad 1930s radio receiver during a thunderstorm. A telephone-line cord and a good user manual also come in the box.

The JT-Fax board fits into any available slot. The program automatically creates a subdirectory and copies software files to it during installation. You configure the program to indicate whether the unit is internal or external, define a 20-character identification sequence to be sent with your fax messages, choose printer and scanner types and ports, set up calling groups of multiple phone numbers, and set other options as well.

JT-Fax would be easier to use only if it read your mind. Once you've loaded the program, you just hold the Alt key and tap F to send a fax. The JT-Fax software comes up. All operations use clear menus that bring up overlapping successive menus as you proceed through a given function. You can step back through menu levels with the Esc key. If you wish, you can also run the program from the DOS command line. The manual doesn't include a tutorial as such, just brief descriptions of all menu selections with line-drawing representations of the menus. You don't need anything more, though online help is included.

Source material for outgoing faxes can be received faxes, ASCII or *PC Paintbrush* files, or screen prints. You can also select Application mode to capture output sent to a printer and convert it to fax format. There is also a compressed mode with which you can fax 132-column data in

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PC MAGAZINE EDITOR'S CHOICE

PC fax is a young technology and, on the PC Labs benchmark tests developed for this review, all the boards revealed their immaturity. They do show promise. They offer the ability to transmit files directly from a PC to a PC, from a PC to a fax machine, or from a fax machine to a PC. That can be handy, but that same ability is limiting if you need to transfer hard copy or convert a file back to text once a transmission is received. PC fax relies on scanners for hard copy transmissions and OCR software to convert graphics files to text. For that reason you should consider using a PC fax board only as a complement to your fax machine, not as a replacement.

As a product category, PC fax isn't quite there. In this review only Quadram's JT-Fax, with its consistent user interface and fine-looking output, appeared to be truly finished. Menus were often inconsistent within the software; we found menu choices that were not implemented and commands that were not documented.

If you must buy now, products you might consider include the JT-Fax. It's priced right at $395, produces good-looking output, and performed our tests faster than a number of the 9,600-bit-per-second boards (even though its rated speed is only 4,800 bps), but its file conversion facility is limited.

If file conversions are important to you, you should check out GammaLink's $995 GammaFax or Datacopy's $1,195 MicroFax. Although we found it difficult to set up GammaFax (and received little help from the documentation), you can customize GammaFax so that a novice could use it. Finally, if you need a graphics editor, you should consider Panasonic's $999 Fax Partner. Granted, the image editor is PC Paintbrush Plus *dropped into Panasonic's software, but it proved to be the most versatile image editor of the boards we tested.*

smaller type to fit normal fax paper.

You can select between normal or high resolution for transmitted faxes and choose gray scale as well. Scanning the color wheel through the JT-Fax to a fax machine produced better quality output.

FAVORABLE FEATURES The JT-Fax has many endearing features. Among them are the ability to send incoming faxes automatically to a printer, transmit faxes directly from a scanner, easily disable fax reception, reduce and enlarge received faxes, and to use letterhead and signature files to transmit with ASCII files. You can also create and use a telephone directory, set up a schedule for later transmission, and view or print transaction logs of transmitted and received faxes.

You can choose to convert files to fax format either during transmission or as a separate prior step. The advantage to formatting on the fly is that large fax format files don't have to take up room on your disk but sending files already converted is faster.

The two limitations to the JT-Fax are speed and the fact that it doesn't work in the background, even though it is RAM resident. At 4,800 bps, fax transmission and reception are slower than with boards using 9,600-bps modems. Whenever you send or receive faxes with JT-Fax, all other activity stops. This could be irritating if you use the board during office hours. However, we expect it would be a problem only in offices that are open 24 hours; most users will batch their documents and schedule them for transmission when telephone rates are low anyway.

The JT-Fax's price and ease of installation, not to mention its fine user interface and the quality output it produces, make it a great buy.—**Bruce Brown** PC

ERASE. ARE YOU SURE?



Every computer user faces this question in some form each day. To erase or not to erase. To save or not to save, when saving means overwriting the previous version of a file. If you answer yes and you're wrong, *countless hours of work will be wiped out by a single keystroke!* And there won't be anything you can do about it, unless you're backed up.

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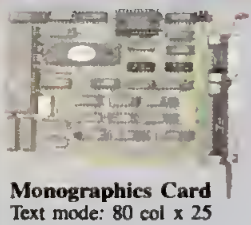
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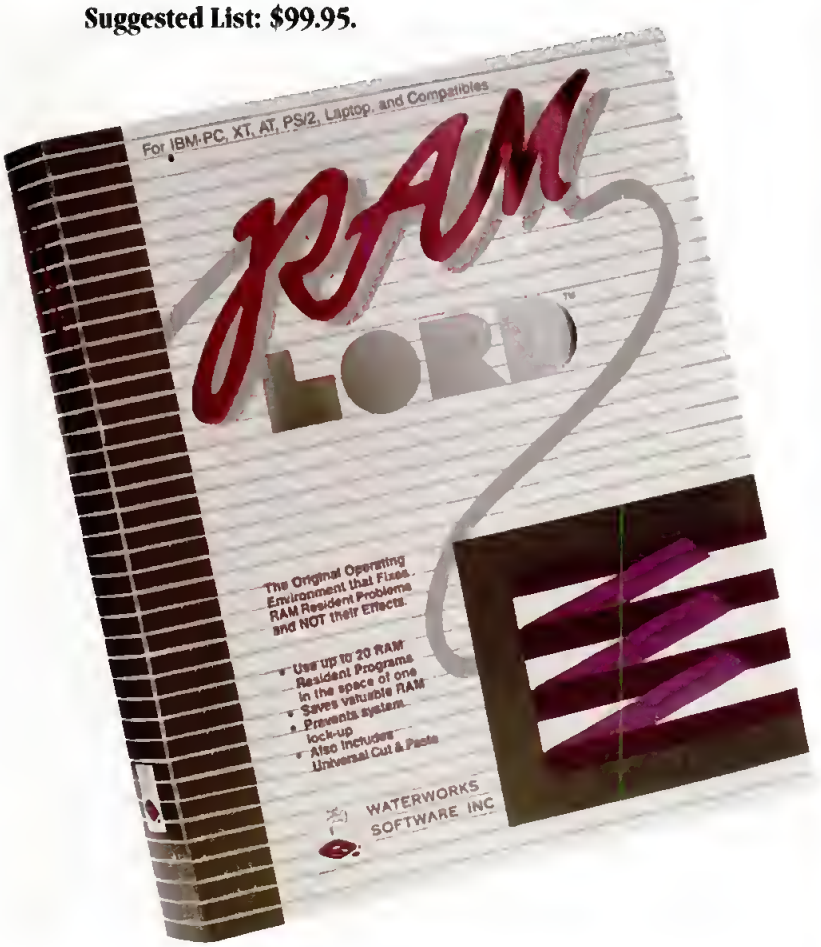
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READING BETWEEN THE LINES

From blood banks to plant floors, bar code systems are a hot item for inventory and data collection. Twenty-seven systems, each for less than $1,000, can help you organize your inventory.

Bar codes, sets of vertical black bars of different widths, are found on practically everything that carries a label. You will even find one on the cover of this magazine.

They're versatile—keeping track of books in libraries and of bags of blood in blood banks, helping control inventory in factory warehouses and recording prices of products in grocery stores, verifying patients' identities and tracking their charges in hospitals. You can use them for anything from data collection and inventory control to limiting access and processing orders.

They're also in demand. In fact, the retail and industrial applications of bar codes collectively represent one of the most dynamic growth markets in U.S. industry today. By 1990 the industry should reach $2.3 billion, a 30-percent yearly increase over the 1985 market value of $625 million, according to a recent report published by Frost and Sullivan Inc., a New York–based investment consulting firm.

The popularity of bar codes has brought increased demand for bar code readers used with a PC. Passing a reader over a code is a much quicker and more accurate way to gather data than having a person collect it by hand. Various studies give error rates for manual data entry of anywhere from 1 in 300 to 1 in 600. Bar code readers have a theoretical upper limit of 1 error in 100,000 tries, making them roughly 20 times more accurate than manual data collection. And with the price of readers ranging from $300 to $1,500, they pay for themselves quickly in reduced labor costs.

COMPLETE SYSTEMS The readers themselves normally come as part of a larger inventory-type system developed and customized by systems integrators. Such a system includes the code, the reader, and customized software to keep track of the data. The range of applications is so vast that no completely general-purpose software package for bar code readers exists. Instead, you'll need a package tailored to your specific application needs.

Many manufacturers of bar code readers can supply software that would be suitable for a particular situation or can recommend a VAR who can supply the requisite software. Our reviews evaluate only the readers.

CODE CONSIDERATIONS The reader and the code to be read go hand in hand. There are more than 30 specifications from which you can choose, with more being developed all the time for specialized applications. The four most common are Universal Product Code (UPC), Interleaved 3 of 9 (Code 39), Interleaved 2 of 5, and Codabar. UPC and Code 39 together compose more than half of the existing market for bar codes.

Codabar, developed in 1970 by Monarch Marketing of Dayton, Ohio, was the first widely used bar code standard. It was

developed as a way to keep better track of blood in blood banks.

In 1973 the Retail Grocery Association, along with IBM, RCA, and Pitney-Bowes, developed the Universal Product Code (UPC), a standard bar code that can be used on all retail products. Using the UPC code, a retailer can group products into standard categories recognizable by all other retailers.

Interleaved 3 of 9 code (Code 39) was developed by Dr. David Allias of Intermec in Lynnwood, Washington. This alphanumeric code has opened the industry to a myriad of manufacturing applications, whereby a code for each individual component is combined into a much longer number for the completed product. This enables manufacturers to keep track of the parts used to create the finished product.

The Interleaved 2 of 5 code can be very dense in comparison with the other specifications, and it is therefore used for applications that require long numbers, as in manufacturing, for example.

All these codes can appear in a variety of shapes and sizes. In some cases, the code may also be accompanied by the human-readable number it represents.

The size and shape of a bar code generally vary between 3 and 10 characters per inch. In general, Code 39 can contain up to 43 characters of information, whereas Codabar can contain 16 characters and UPC, 10. The density of the code is usually defined as low, medium, high, or ultra high. While most currently available readers read the low-, medium-, and high-density bar codes, you'll need a special reader for the ultra-high-density codes.

The type of bar code system you need to purchase depends in part on the quality of the bar code you need. If you're only going to read a code once or twice, the code can be lower in quality or less durable than codes that you'll read more frequently. For example, a bar code on a box in a warehouse will probably be read only a couple of times: when it is put into the warehouse, when it is shipped, and possibly once in between for an inventory check. However, a personnel ID card providing access to various areas of a factory must withstand being read several times a day for several years.

You can buy preprinted bar codes from companies like Computype in St. Paul, Minnesota, or Concord Technologies in Marlboro, Massachusetts, or you can purchase software to produce them on a dot matrix or laser printer. The preprinted labels will be of better quality than those generated on a laser or dot matrix printer, but they allow less control over the numbers they contain.

Some applications may require more than one type of bar code. Retailers, for instance, may use UPC on their products and Code 39 for employee ID cards. Most of the readers we tested could read most of these codes, and many vendors provide custom software to read less-common codes. Some readers will automatically read several types of codes, while others have small jumpers you must set to change the type of code. The standalone units may include the changing of the code type as a programmable option.

To obtain more information on the uniform symbol specifications for many of the popular codes, contact Automatic Identification Manufacturers (1326 Freeport Rd., Pittsburgh, PA 15238).

ENTERING DATA Once you've found the type of code you'll want to use, you can consider the reader. The available types of readers include wand readers, swipe readers, gun readers, and standalone units.

All bar code readers work on the same principle: they detect the difference between the bars and the background and translate the code into a string of numbers and letters.

To do so, the reader's sensor emits a beam of light directed toward the bar code. On wand readers the light is typically either visible or infrared; on the guns, a low-power laser beam. The black bars of the code reflect little of this light, while the spaces between the bars reflect most of it.

A detector on the sensor notes how much of the beam is sent back to the reader. The whole bar code is scanned either by moving the reader over the code, in the case of the wand or swipe reader, or by the beam of light being moved, as in the laser scanners. This movement causes a change in the signal that is seen by the sensor detector.

The signal obtained is then amplified and sent to the decoder, which translates the analog signal from the bar code into a digital signal. In many readers, the decode IC is capable of detecting the type of code being used and of providing the translated number as an output. On others, you may need to set the code type to be read before the reader will give you the number or the raw data.

Systems transfer data to the PC several different ways: via the keyboard connector, with an expansion board, or via a serial port. You can find various types of readers that connect to the PC by using one or more of these methods.

WAND READERS A wand reader is a penlike device that you drag across the surface of the code. The optical sensor on the end of the pen sends the signal to a decoder, which then transfers the digital output to the host computer via a cable.

Since its design is simpler, this type of reader tends to be cheaper than the laser beam types. But since it makes physical contact with the code, the number of times the code can be read before it wears away is limited.

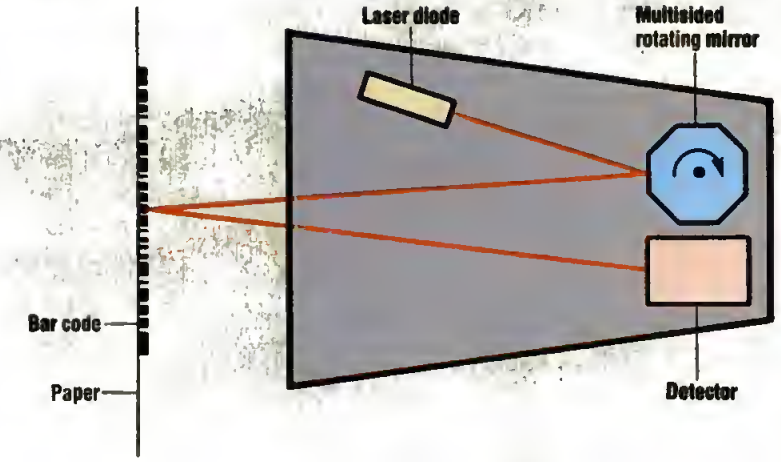
While the wand readers we reviewed can cost from as low as $385 to as high as $995 (including an interface device), the price of laser scanners, along with their interface devices, ranges from $639 to $1,890. And standalone units—which incorporate either wands or lasers—will set you back anywhere from $676 to $1,935.

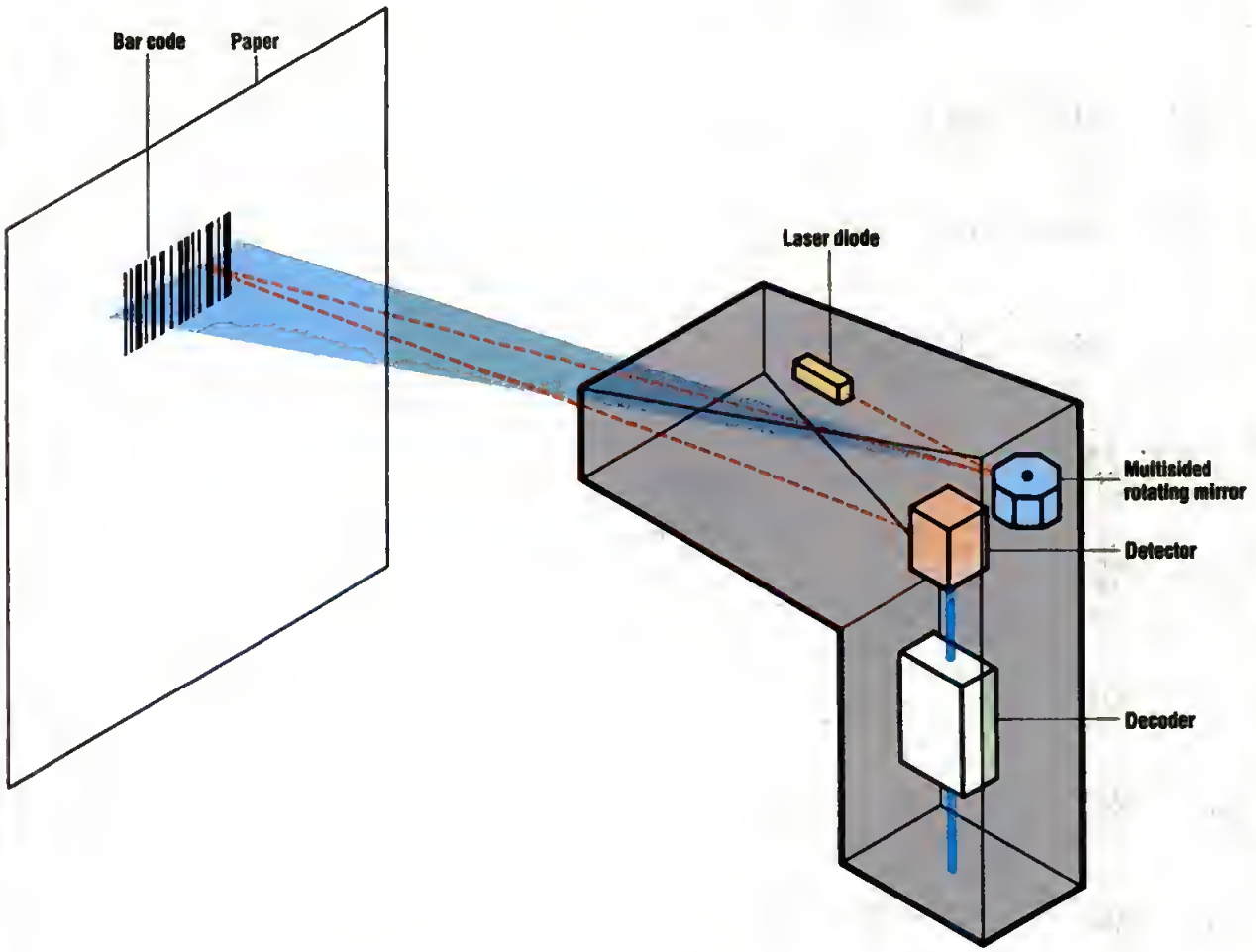
Also, aside from the wand's tip tending to wear down from its contact with the code, you also need to be careful of the angle between the wand and the surface being read. Unless you can use a wand at a variety of angles, you'll have a difficult time using it wherever the bar codes are on stacked boxes.

Wand readers use several different types of sensors to read the codes, so you can purchase a reader that can work with a variety of inks or colors. You can obtain systems with an infrared detector, for example, where the bar code is not visible to the naked eye because a red ink screen is placed over the image. The sensor can read the number through the red screen without any problems. In addition, infrared readers are more tolerant of poor-quality bar codes.

How Moving-Beam-type and Raster-Scan-type Bar Code Readers Work

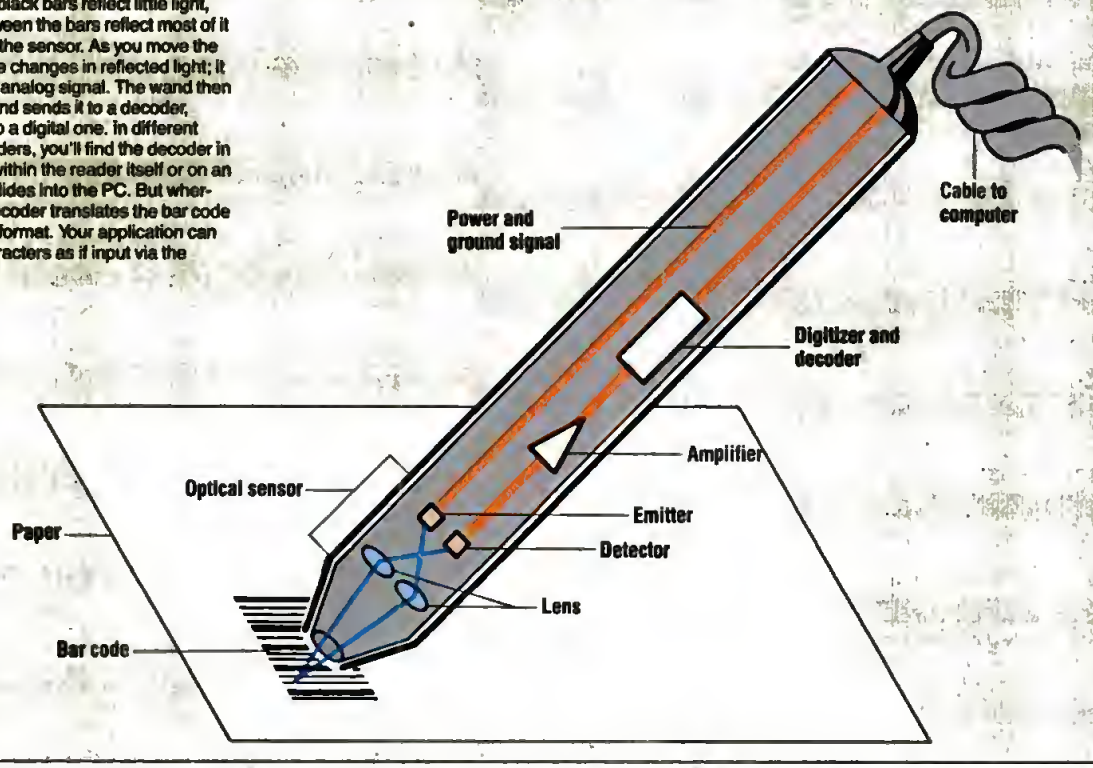
Moving-beam-type bar code readers share the same basic principles for reading codes that are employed by wand readers; the only difference lies in the way they obtain the initial analog signals. With the moving-beam readers, the user does not have to touch the code or move a wand over it. Instead, a rotating mirror scans a laser beam across the bar code. The raster-scan type works the same way except that it sweeps the beam across the code several times.





How a Wand-type Bar Code Reader Works

A wand reader is a penlike device that is dragged across the surface of the bar code. In the wand, an optical sensor directs a beam of light at the code. The code's black bars reflect little light, while the spaces between the bars reflect most of it back to a detector on the sensor. As you move the wand, it can detect the changes in reflected light; it interprets them as an analog signal. The wand then amplifies this signal and sends it to a decoder, which translates it into a digital one. In different types of bar code readers, you'll find the decoder in different locations—within the reader itself or on an expansion card that slides into the PC. But wherever you find it, the decoder translates the bar code signals into an ASCII format. Your application can accept the ASCII characters as if input via the keyboard.



SWIPE/WEDGE READERS The swipe, or wedge, reader is designed to read bar codes placed on a card that is usually similar to a credit card. This type of reader is frequently used for ID purposes to control access to rooms or computer terminals. You push the card through a slot that contains the optical sensor.

Since the code is in direct contact with this type of reader, it suffers from many of the same disadvantages that beset the wand readers.

GUN READERS Gun-type readers use either a moving beam or a raster-scan light source to detect the bar codes. These readers do not have to touch the bar code; instead, moving-beam-type readers scan a laser beam across the bar code using a rotating mirror to sweep the light beam across the code. Raster-scan types do the same thing, only they scan the code several times so that the beam covers a rectangular area.

The moving-beam-type reader is a simpler mechanical design, and consequently less expensive than a raster-scan reader. You can get a moving-beam-type reader for as low as $390, and a complete bar code system—including a moving-beam reader, interface card, and software—for $639 from Seagull Scientific Systems. Raster-scan readers, however, will cost you at least $795 for the gun alone and as much as $1,695 for a system including self-contained internal decoding and an interface/power supply unit. This price difference is partly due to the fact that the raster-scan reader is more likely to be able to decipher the code.

Laser gun readers are preferable to wands for hostile industrial environments, since they do not make contact with the bar code. Consequently, the code does not suffer as much from wear and tear as do codes read by a wand.

Some of the laser-gun-type readers, in fact, can read codes that are several feet away. You can bolt many of them to a conveyor belt system; they will read the codes on the sides of products moving so fast on a production line that no person could read them.

KEYBOARD VS. EXPANSION BOARD You can connect a wand or a gun reader to the PC either via the keyboard connector or with an expansion card. An expansion card best serves stationary applications such as order entry or tracking work-in-progress. Because the reader is attached to the PC and you must bring the bar code to the computer, you wouldn't be able to use

it in a warehouse environment, where you'd have to bring the reader to the inventory.

If you select the type of bar code reader that comes with an expansion board, you will be able to use the reader with a greater number of PC clones. But such systems have the same limitations for applications as the keyboard-attached readers. Since these readers are first attached to the expansion board via a cable and then the decoding is generally done on the expansion board, you must use them in close proximity to your PC.

STANDALONE UNITS Standalone units, as the name implies, do not have to be hooked to the PC during data collection. The reader itself stores the codes in ASCII format, then transmits them to the PC via the serial port.

The level of sophistication for these standalone readers varies dramatically. While some include programmable features and little printers, others have only a visual display and a few keys. These readers are not limited to working on PCs but can be attached to any host that will accept the data syntax of the unit. The weight of these standalone units may be a significant factor in your final choice of a suitable reader.

OTHER CONSIDERATIONS Though they are accurate, bar code readers still make errors, so all systems have some method of indicating a successful read. Again, your application will dictate whether one method is better than another. A reader typically signals a good read by emitting an audible signal, but this may be annoying or inappropriate in an open office plan and inaudible in an industrial environment.

TESTING THE UNITS Due to the number of bar code readers on the market, we limited our selection to products under $1,000, including decoder, wand, and cables. Higher-end readers will be reviewed in a future issue of *PC Magazine*.

We tested the readers' performance on a number of codes, using samples of the most common bar code types: UPC, Codabar, Interleaved 3 of 9 (Code 39), and Interleaved 2 of 5.

Our samples were printed on both a laser and a dot matrix printer. To further simulate real-world conditions, we printed them with a moderately used ribbon. As you can see in the reviews, the poor print quality created more trouble for some readers than others.

We tried the readers with colored backgrounds and on curved surfaces. We also tested them on actual products, including shrink-wrapped boxes and shiny cans.

OUTLOOK A cheap, accurate method of labeling and collecting data, the bar code reader has endless applications. In the next few years, the biggest area of improvement will be not in the accuracy of the readers, but in the speed of reading.

Another improvement will be in the readers' increased use in industrial and office applications, where an accurate inventory system will allow a reduction in inventory. The use of bar code readers will become more integrated with order entry, manufacturing, and accounting.

Reviews of 27 bar code readers follow, in alphabetical order by company name. Other companies that produce under-$1,000 bar code readers not available at the time of this review include Canon, Nippon, Caere, Interface Solutions, Compsee, Hewlett-Packard, Metrologic Instruments, and IBM.

Caroline Halliday is an engineer and consultant with High Tech Aid, specializing in technical documentation and teaching for the PC environment.

OUR REVIEWERS

Greg Alwang is a consultant and writer for Soft Industries Corp., a Connecticut-based microcomputer consulting firm.

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M. David Stone, a contributing editor of *PC Magazine*, is a free-lance consultant specializing in computer communications.

ACCU-SORT SYSTEMS INC.

Accu-Sort Model 4410 Wedge

The Model 4410 Wedge, from Accu-Sort Systems, is a wedge-style bar code reader that comes with a decoder unit, a keyboard-to-PC communications cable, a power cable, a wand with a visible red light, its own internal power supply, and a reference manual. While the $495 package

PC MAGAZINE FACT FILE



Accu-Sort Model 4410 Wedge
Accu-Sort Systems Inc.
511 School House Rd.
Telford, PA 18969
(215) 723-0981
List Price: $495, for 4410 Wedge decoder unit, red light wand, and cables; LaserScan 8100 or 7100 laser scanner, $1,250.
Requires: IBM PC, XT, AT, or compatible.
In Short: The 4410 Wedge is an inexpensive unit that comes with a wand but also works with a laser gun. It works with a limited number of codes and isn't programmable, but it does include a full-duplex serial communications port on the decoder box.

CIRCLE 699 ON READER SERVICE CARD

includes a wand, the 4410 also works with laser guns, available for an additional $1,250. We tested the 4410 with the Symbol Technologies LaserScan 8100 laser gun as well as with the wand.

A low-cost general-purpose decoder, the 4410 can also be used to transfer serial data, since the decoder unit has a 9-pin, full-duplex serial input/output port that allows the host PC to communicate with other computers and scanning devices.

When in use, the wand or laser gun scanning unit emits a beam of red light. When a bar code is scanned, a light sensor detects contrasts in the light reflected by the bars. The reader measures the time intervals in which these contrasts occur and sends this information in the form of digital signals to the decoder unit.

The decoder unit uses the IBM keyboard protocol to translate the digitized bar code measurement into keyboard input, so that the PC can understand the data. An audible beep indicates a successful read.

The 4410 can read Code 39, Interleaved 2 of 5, and UPC A and E formats, with the default set to read Interleaved 2 of 5 and Code 39. In order to read the UPC codes, you must set DIP switches on the decoder unit. The 4410 is not programmable.

The reader worked well on standard-size laser-printed codes. The lowest number of successful reads was with very densely packed codes; the 4410 did not work very well with loose codes. Usually, it read all codes on the first try. The wand was better than the laser gun at reading dot matrix output, but the laser gun was superior at reading laser-printed output.

Both units performed well when held at a 90-degree angle; for best results, you should avoid holding either one at an angle of less than 70 degrees. When using the laser gun, at times you have to experiment with the distance between the gun and the printed material. Moving the gun farther away from less densely printed codes often helps.

The reference manual includes extensive information about installing and operating the unit. It also discusses preventive maintenance and troubleshooting and provides a full schematic of the decoder unit.

The 4410 comes with a 1-year warranty. You can obtain a service contract for a longer period at 5 percent of the original purchase price for each additional year. Support is available at no charge via an 800 phone number, and replacement wand tips are available for $20.

The 4410 has its drawbacks: it isn't programmable, it doesn't read as many codes as some other units, and it uses DIP switches to change code groups. But the unit offers low price, ease of use, and a serial communications port.

—Greg Alwang

AEDEX CORP.

Aedex BCD-200

The Aedex BCD-200 is a configurable bar code reader system ($550 not including a reader, $145 for a wand reader, $795 for an MBL300 laser gun). Connecting to a PC's serial port, it acts as a wedge between the keyboard and computer.

You can also use the BCD-200 system with terminals and computer networks, and with various types of wand-contact scanners and hand-held laser scanner guns. The basic system includes the decoder unit, a power supply and cable, and a female-to-female 9-pin to 25-pin serial cable.

The BCD-200 auto-discriminates between UPC A and E, EAN/JAN, Code 39, Interleaved 2 of 5, Codabar, Code 11, Code 93, and Code 128 bar code types. You program all parameters and settings through a bar code menu to set bar code symbologies, data format, data transmission characteristics, data communications rate, and beeper volume. Programmed settings are saved in nonvolatile memory using static RAM.

To hook up the system to a serial board, you connect the 25-pin end of the included interface cable to the serial port on the back of the computer and the 9-pin end to the back of the decoder unit.

The BCD-200 comes with default settings, but you have to set the bit-per-second rate to coincide with the bps rate of your serial port. Once you figure out how to program the unit with the included bar code menu card, changing settings is easy. The manual includes complete information on programming and gives lots of examples.

The reader beeps to indicate successful reads. The beeper function has seven volume levels and can be disabled. You can also input and edit entries with the keyboard, but not at the same time or the keyboard entries will be garbled.

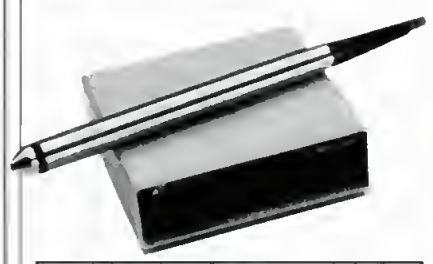
The BCD-200 reads very well with the wand and almost perfectly with the laser gun. A good example of the performance of the unit with the laser gun is that the reader recognized every single dot-matrix-printed test code on the first pass!

The product was easy to use with both types of reader, but the laser gun made it seem almost too easy. The BCD-200 manual includes sections on configurations, setup, and operation, using various input devices, troubleshooting and maintenance, and general specifications.

The hardware has a 1-year warranty, but the vendor reports that there are very few failures. While primary-level support is usually given by the systems integrators who sell this and other Aedex products, the vendor provides free backup support.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE



Aedex BCD-200
Aedex Corp.
1070 Ortega Way
Placentia, CA 92670
(714) 632-7000
List Price: $550 for BCD-200 decoder box, power supply, and cables; wand with RJ41 connector, $145; MBL300 laser gun scanner, $795.
Requires: IBM PC, XT, AT, or compatible or dumb terminals; serial port.
In Short: The Aedex BCD-200 is a powerful, flexible decoder that works with both contact readers and moving-beam laser guns. The unit is programmable with bar code menus and saves settings with nonvolatile RAM. The decoder used with a laser gun sets the standard for other units.

CIRCLE 698 ON READER SERVICE CARD

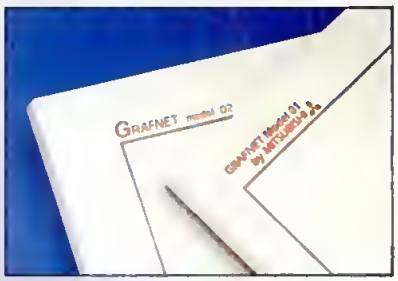
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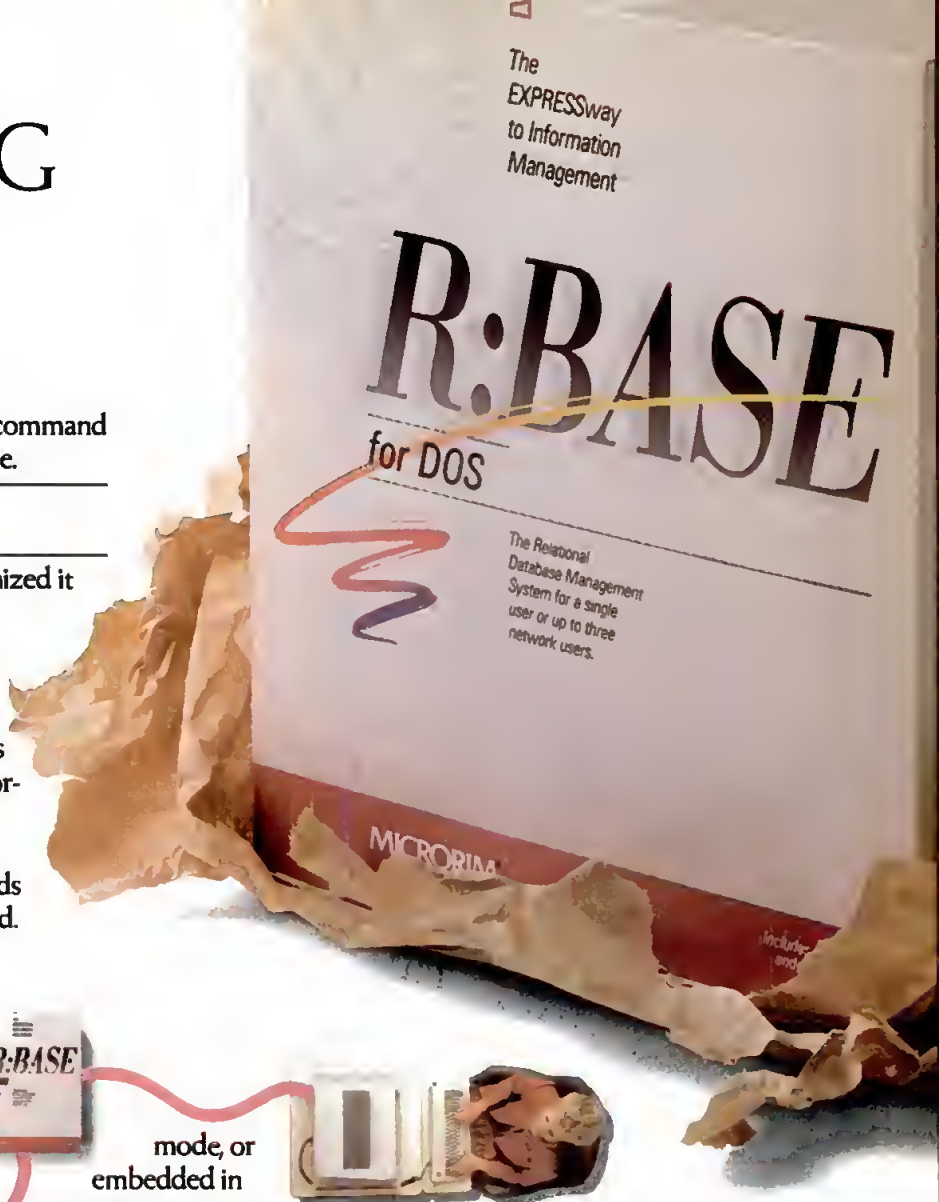
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CIRCLE 366 ON READER SERVICE CARD

The BCD-200 is used heavily in point-of-sale and merchandise tracking and distribution applications. A typical site usually has between 6 and 15 units, and many of these units are used with minicomputers and microcomputer networks as well. The vendor estimates that about 40 percent of the BCD-200 units are used with PCs.

The difference in accuracy and speed using the laser gun with the BCD-200 unit makes that combination a must for high-volume applications. The performance of this system is hard to beat.

—Bruce Brown

AEDEX CORP.

Aedex BCS-125SPC

The Aedex BCS-125SPC is a powerful bar code system that plugs directly into a PC expansion slot. Like other expansion card systems, it has a 10- to 15-fold advantage of speed because it does not act as a "wedge" between the keyboard and the computer. The result: it can send data to the computer at 9,600 bits per second rather than being limited to the keyboard's slower 600 to 900 bps.

You can attach either wands or magnetic stripe readers to the BCS-125SPC; the unit does not work with laser gun readers. The system comes in two versions, the BCS-125S ($495) and the BCS-125SPC ($695). Both models have the same bar code reading capability, but the SPC version, which we tested, adds two sets of ROM-based firmware called *Print-Pak Plus* and *Comm-Pak*.

Print-Pak enables you to print bar codes. With this feature, you can use normal application software such as word processing, spreadsheet, and database programs to select and send data to a printer. However, when you precede a filename with a special code, the ASCII characters normally sent to the printer are converted to bar code symbols. You also can select bar code type, height, density, and horizontal positioning.

The *Print-Pak Plus* firmware works with IBM Graphics, Epson FX, and HP LaserJet Plus/HP series II printers as well as printers compatible with the named types.

The *Comm-Pak* firmware controls one or two serial ports that you can hook to your computer—they don't come with the BCS-125 units. *Comm-Pak* allows you to use any serial data input device hooked up to COM1 or COM2 just as if it were sending keyboard data.

Input can be accepted from devices such as digital scales, voice recognition units, and magnetic stripe readers. You can also use the *Comm-Pak* to output data to portable terminals, remote displays, or other peripherals that receive serial data.

An example of how you'd use a fully loaded unit in a point-of-sale application would include the BCS-125's working with a wand to read price and inventory control tags—controlling a digital scale to weigh goods sold by weight and a magnetic stripe reader for credit card data. Though you could input data from all three devices as well as from the computer's keyboard, the computer would interpret that it all came directly from the keyboard.

Since many application programs cannot access serial ports directly, the *Comm-Pak* firmware adds a significant utility to the BCS-125 systems.

To install the BCS-125 systems, you must have a free slot in your computer. An advantage of this system is that there are no external pieces besides the wand.

When tested, the BCS-125 worked very well; the only troublesome codes were the most densely packed versions. Different wands are available for varying code density. We tested three different wands and found, for example, that the low-density wand worked best with dot-matrix-printed codes, as expected. The wand type used with the Aedex unit worked at a wide range of angles and also read codes while either mounted or held vertically.

■ The BCS-125SPC has a 10- to 15-fold speed advantage since it doesn't act as a "wedge."

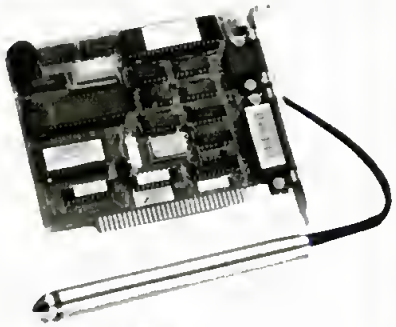
The BCS-125 systems come with a ring-binder manual with complete information, including programming the unit to work with both the *Print-Pak Plus* and *Comm-Pak* options.

All Aedex hardware has a 1-year warranty. The units have a nominal 3-year design life, but Aedex has been selling reader systems since 1983 and reports no significant failures after the initial bum-in period.

All Aedex systems are sold through system integrators and resellers. Typical uses for the BCS-125 systems are for point-of-sale and video rental outlets, which normally include three to five units at one site. Since the BCS-125 plugs directly into the PC motherboard, all of the units operate with PCs.

The BCS-125SPC and the BCS-125S give you a great deal of control over bar code input and output. The systems require only .6 amps from the PC's power supply and save valuable workstation table space.

FACT FILE



Aedex BCS-125SPC
Aedex Corp.
1070 Ortega Way
Placentia, CA 92670
(714) 632-7000
List Price: $695 for half-card, wand with 9-pin connector, *Scan-Pak*, *Print-Pak Plus*, and *Comm-Pak* firmware; BCS-125S, including half-card, wand, and *Scan-Pak* firmware, $495.
Requires: IBM PC, XT, AT, or compatible; half slot.
In Short: The Aedex BCS-125SPC is a price-competitive, PC bus unit. Because it is not a wedge, it can transmit data much faster than keyboards and is not dependent on keyboard type. The *Print-Pak Plus* and *Comm-Pak* software add bar code printing capability and the ability to control two serial ports for additional input devices.
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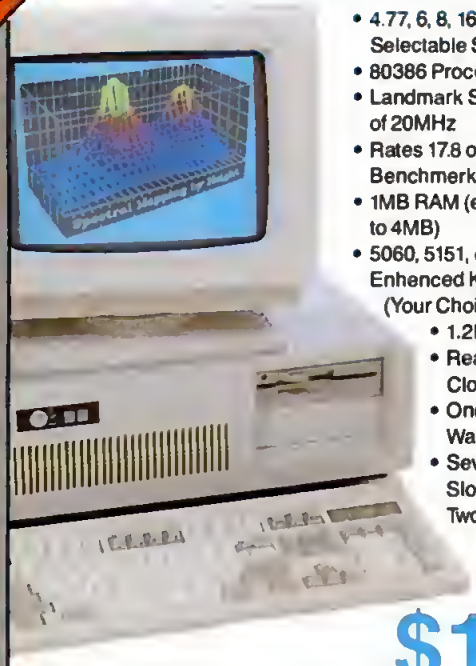
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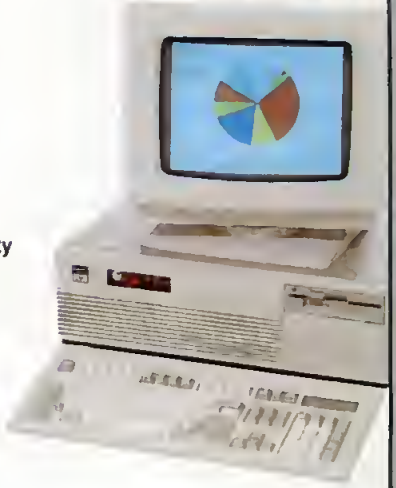
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PC MAGAZINE Editor's Choice Feb 16, 1988

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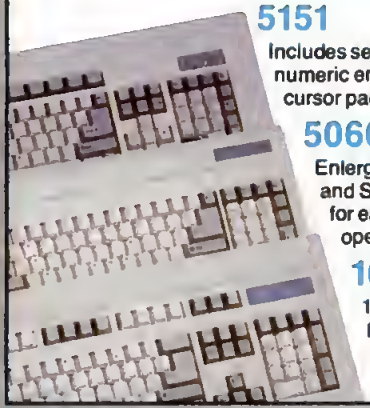
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PC MAGAZINE Editor's Choice Feb. 18, 1987

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PC MAGAZINE

Editor's Choice
May 31, 1988



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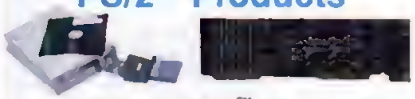
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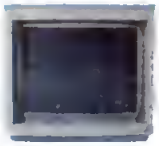
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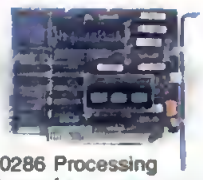
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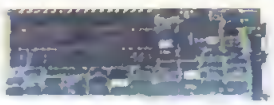
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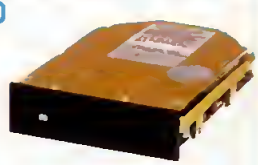


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External modem	$89✓	$89✓	$89●	$89●	$89✓	$89	$89✓
Printer cable	$8.95	$8.95	$8.95	$8.95	$8.95	$8.95	$8.95
5.25" 360KB Floppy Disk	$99	$99	No	No	$99	No	$99
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In addition to letting you control other computer serial ports, the more expensive SPC version also enables you to create bar codes using dot matrix and laser printers.—**Bruce Brown**

AEDEX CORP.

Aedex MSR100/MBR150

The Aedex MSR100/MBR150 is a magnetic stripe reader system with an optional bar code reader. This unit is the low-cost model of the Aedex line; the price is $395 for just the magnetic stripe reader and $695 if you want the bar code reader as well. The MSR100/MBR150 comes with few frills, but it is very easy to use, and its performance in our testing was excellent.

The bar code reader consists of a decoder unit, a wand reader, and a specially designed RS-232 cable. The decoder unit is an external box that attaches to a computer or terminal serial port with the cable and then acts as a wedge between the computer and its keyboard. The MSR100/MBR150 has its own external power supply.

The system is especially intended for point-of-sale applications and other situations that require both bar code and magnetic stripe input. Typical uses include merchandise and inventory distribution, equipment or videotape rental, digital weighing, and access control.

Besides using a single MSR100/MBR150 with computers or terminals, you can also daisychain several of these devices to connect with just one serial port on one computer. This reduces hardware costs and simplifies the setup of applications, since only one serial port is used for data input. A videotape store, for example, could connect several readers to its single PC and thus be able to read many tapes into inventory simultaneously.

The wand reader automatically discriminates among five major bar code symbologies: Codabar, Code 39, EAN/JAN, Interleaved 2 of 5, and UPC A and E. You can't program the unit at all, so you are limited to these five codes. The decoder beeps when a read is successful, but the volume is not adjustable.

The wand reader performed very well on bar code tests, with only a few problems. Tests with very-high-density bar codes gave the MSR100/MBR150 a great deal of trouble, especially those of Code 39.

Its ability to read low-density codes improved when the wand was moved more slowly. The wand worked equally well when held at angles ranging from 30 to 90 degrees.

The system has a 1-year warranty. The documentation consists of a few sheets that adequately explain installation and features. If you have problems with the unit, you can send it, postpaid, to Aedex in California. After repairing or replacing the malfunction, Aedex will ship the unit back to you at its expense.

The MSR100/MBR150 combination stripe and bar code reader is an accurate, easy-to-use system that takes up very little table, desk, or counter space. The only drawback with this system is that you cannot use a laser gun code reader.

—**Bruce Brown**

PC MAGAZINE FACT FILE



Aedex MSR100/MBR150
Aedex Corp.
1070 Ortega Way
Placentia, CA 92670
(714) 632-7000
List Price: $695 for decoder box with magnetic strip reader and wand LED reader with RJ41 connector, cables, and power supply; magnetic stripe reader only, $395.
Requires: IBM PC, XT, AT, or compatible; serial port.
In Short: The MSR100/MBR150 is a combination swipe and wand wedge-style bar code reader. The price/performance ratio of this unit is very good, but the unit does not work with laser guns, a disadvantage for some applications.
CIRCLE 696 ON READER SERVICE CARD

BAR/CODE INC.

BC 105 IBM FOX
BC 110 AT FOX

Bar/Code Inc. produces two versions of its wedge-style bar code reader: the BC 105 IBM FOX and 110 AT FOX. The 105 is suited for use with IBM PCs, XTs, and compatibles and costs $595; the 110, at $695, is intended for ATs and compatibles.

There is no functional difference between the two; each model number merely designates the appropriate keyboard connector. The 105 and 110 each come with

PC MAGAZINE FACT FILE



Bar/Code Inc.
1104 Summit, #106
Plano, TX 75074
(214) 424-9491

BC 105 IBM FOX
List Price: $595 for decoder box and Opticon medium-resolution, high-resolution, or infrared wand.
Requires: IBM PC, XT, or compatible.
In Short: The BC 105 IBM FOX is easy to hook up, program, and use. The only drawback to this otherwise fine performer is the necessity of having different units for different computers.
CIRCLE 695 ON READER SERVICE CARD

BC 110 AT FOX
List Price: $695 for decoder box and Opticon medium-resolution, high-resolution, or infrared wand.
Requires: IBM PC AT, 286, or compatible.
In Short: Like the BC 105 IBM FOX, the BC 110 AT FOX is easy to hook up, program, and use. Also like the BC 105, its only drawback is the need for different units for different computers.
CIRCLE 694 ON READER SERVICE CARD

the FOX decoder unit, a keyboard interface cable, an Opticon wand scanner, and a user manual.

Both readers were designed for paper tracking, inventory, and time and attendance applications. According to the vendor, however, the readers have many other general uses. They cover a wide range of symbologies—14 in all—including Ames, Codabar, Code 11, Code 39, Code 93, Interleaved 2 of 5, and UPC A and E. The FOX automatically distinguishes among the codes, without requiring any programming of the unit or setting DIP switches.

The reader connects between the keyboard and the computer; installation is simple. The FOX comes with a convenient setup menu sheet, a laminated piece of paper that you scan with the wand. The menu sheet lets you easily program the unit by altering parameters. For example, you can change the default parameters from sending a carriage return after each code and assuming the CapsLock key is on, to sending no carriage return and turning off the CapsLock key.

The setup menu sheet will also allow you to change the length of characters for each code; to turn on or off specific code recognition; and, in some cases, to turn on or off parameters of particular codes, such as using a checksum with Code 39 or not. A review command will display all current settings on the screen.

Both FOX models performed very well in our tests. The reader beeps after a successful read but remains silent if the read is unsuccessful; the beep can be turned off from the setup menu sheet. Very tightly packed code gave the FOX the most trouble, as is the case with most readers.

The reader works fairly well with dot-matrix-printed bar code, but its performance was much more consistent with laser printing. Both models were able to read bar code on curved and shiny surfaces and under shrink-wrap without problems.

The wand worked best at angles from 45 to 90 degrees; it is fairly light in weight with a comfortable feel. Speed and straightness of motion are more important for obtaining successful reads than is wand angle, and moving the wand quickly is especially important for less tightly packed code. The 72-inch cable gives a fair range of motion for reading different sources.

A ring-binder user manual clearly explains installation, use, and maintenance. There is also a glossary and a reference section.

In addition, all Bar/Code hardware comes with a 1-year warranty. The vendor says that most of the products sold since 1983 are still in service, so you should expect the unit to last 4 to 5 years. The manufacturer provides free telephone support.

The 105 and 110 are easy to set up and use. The inconvenience of requiring a 105 for PCs and XTs and a 110 for ATs makes a difference only at sites with a mixture of computers.—**Greg Alwang**

BARCODE INDUSTRIES INC.

Mindreader MR-23B

Barcode Industries' Mindreader MR-23B is an accurate, moderately priced (complete for $455, the board alone for $315), half-length PC board that acts as a wedge between the computer and keyboard, working with PCs, XTs, ATs, and compatibles. While the MR-23B is designed for general-purpose applications, it is particularly suitable for point-of-sale applications.

Two sets of DIP switches on the interface board control all parameter settings. Before you install the MR-23B, check the switch settings to be sure that the board will work with your computer and to verify the other settings.

The MR-23B can read and automatically discriminate among Codabar, Code 39, Interleaved 2 of 5, and UPC A and E bar code types; you can't program the MR-23B to read any other codes. The default settings and specific options can be set by using the DIP switches on the interface board.

When tested, the MR-23B did a terrific job. It read the most dense code samples of several bar code types much better than other readers. Also, the MR-23B read most dot-matrix-printed bar code samples on the first pass. It read code on aluminum cans, on wax boxes, through shrink-wrap, and on Federal Express bills (a very-low-density code) with no problems.

The decoder beeps when it registers a successful read, but the volume is not adjustable. You cannot erase duplicate entries using the wand, but you can use the keyboard for data entry or editing. Also, you cannot use laser guns with the MR-23B—only wand and magnetic stripe readers. Since you can attach two input devices to the board, you can use a wand and magnetic stripe reader at the same time.

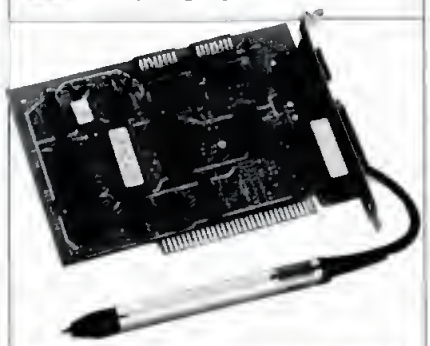
The cord on the wand extends to 98 inches, making it relatively easy to reach items that you cannot either easily move to or fit on the surface of your desk or your PC's bench.

For reference, a 40-page user guide includes complete installation, operation, and troubleshooting information.

Barcode Industries' hardware comes with a 1-year warranty on parts and labor. After that, a service contract is available at 10 percent of the original purchase price per year. While the first line of support for users is through dealers or third-party vendors, the company also provides support at no charge.

If you don't need to use a laser gun, if you only have to read the codes that the

PC MAGAZINE FACT FILE



Mindreader MR-23B
Barcode Industries Inc
Ammendale Technology Park
12240 Indian Creek Ct.
Beltsville, MD 20705
(301) 498-5400
List Price: $315 for half-length decoder board and cables; Bar Pen 40 LED red wand, $140.
Requires: IBM PC, XT, AT, or compatible; half slot
In Short: The Mindreader MR-23B is a half-length board that acts as a wedge between the keyboard and the PC. Two input devices can be attached at the same time. This unit is very powerful, giving accurate reads of five major bar code types, and is a best buy.

CIRCLE 693 ON READER SERVICE CARD

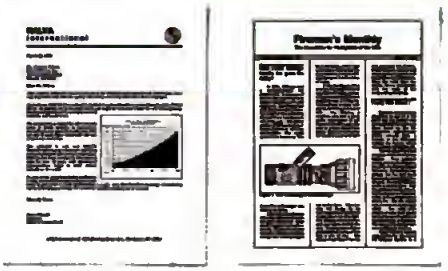
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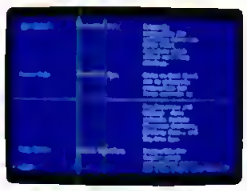
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And WordPerfect 5.0 lets

mances can be ing WordPerfect 5.0.



you create documents containing numerous type fonts and font sizes without having to change your margins, tabs or column definitions. You can also choose whatever typefaces your printer allows—from an assertive, extra-large times roman bold to an elegant, extra-fine italic—and 5.0 makes all the necessary spacing adjustments automatically as you go.



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WordPerfect 5.0's improved Preview feature lets you see what your document will look like before you print.

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Additions also include automatic referencing, automatic redline and strikeout, an alternative mnemonic interface, enhanced macro and macro editing capabilities, and improved parallel columns.

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WordPerfect® Document Processing

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CIRCLE 508 ON READER SERVICE CARD

MR-23B can handle, and if you have an extra slot in your computer, this unit is a terrific performer for a modest amount of money.—**Bruce Brown**

BARCODE INDUSTRIES INC.

Mindreader MR-210SP

Unlike Barcode Industries' MiniBar and Mindreader MR-23B, the $525 Mindreader MR-210SP bar code reader does not come with any one input device. Instead, it can function with a number of devices, including laser guns and wands. We tested the unit with a Symbol Technologies laser gun.

The MR-210SP unit itself is an external box measuring 6 by 4.7 by 1.2 inches. It supports Code 39, Interleaved 2 of 5, Codabar, UPC/EAN, and Code 128 formats. The company says that it will develop custom software for additional codes.

On our performance tests, the MR-210SP did extremely well, reading most samples on the first pass, whether the label was printed on a laser or on a dot matrix printer. The laser gun read code through shrink-wrap just fine and also read laser-printed code wrapped around a can. The gun did not read silver-on-white code on an aluminum can.

The laser gun worked well, when kept at the proper distances for various densities of code. The best distance for reading low-density code, for example, was 6 to 10 inches; we could read high-density code as close as 1 to 3 inches.

The 44-page user manual, written in outline form, is sparse but includes clear explanations with complete description, installation, operation, and troubleshooting information.

Barcode Industries' hardware comes with a 1-year warranty on parts and labor. After that, a service contract is available at 10 percent of the original purchase price per year. While the first line of support for users is through dealers or third-party vendors, the company also provides support at no charge.

The Mindreader MR-210SP is Bar Code Industries' most flexible unit. It is designed for universal applications and is used for a wide variety of bar code reading situations.—**Bruce Brown**

PC MAGAZINE FACT FILE



Mindreader MR-210SP
Barcode Industries Inc.
Ammendale Technology Park
12240 Indian Creek Ct.
Beltsville, MD 20705
(301) 498-5400
List Price: $525 for decoder box and cables.
Requires: IBM PC, XT, AT, or compatible.
In Short: The Mindreader 210SP is an external keyboard wedge unit that performs superbly and works with laser guns as well as wands, badge readers, and magnetic stripe readers.

CIRCLE 002 ON READER SERVICE CARD

BARCODE INDUSTRIES INC.

MiniBar

Barcode Industries' $730 MiniBar, a combination wedge-style bar code reader and magnetic stripe reader, includes the MiniBar wedge, a Barcode Bar Pen 40 LED red wand, a Mag Scan 65 Scanner stripe reader, the cables you need to hook it all up, and a compact but complete, well-written user manual. Sold by distributors, the MiniBar can work with many terminal, computer, and input device configurations, so it has a wide range of applications.

The reader accepts data either from the wand or from the magnetic stripe reader, decoding the data and transmitting the result in a format that emulates signals from the keyboard. The system can read six popular bar codes with a default configuration of Codabar, Code 39, EAN, Interleaved 2 of 5, and UPC A and E.

You also can program other code types and parameters by scanning the bar code programming menus in the user manual. For example, you can adjust the volume of the beep indicating a successful read to one of four levels with a programming menu.

You can adjust the parameter settings to configure the MiniBar to work with 110 different terminals and computers. Another option is configuring the unit either as a single-port RS-232 output device (for transmission to serial ports on terminals or cash registers) or as a dual-port serial device (to work between an asynchronous terminal and a host computer). Several combinations of two input devices can connect to the MiniBar at the same time; for example, two wands, a wand and a magnetic stripe reader, a stripe reader and a laser diode scanner, and various RS-232 devices.

The unit worked well, but it didn't achieve the same level of successful reads as did many of the units we tested. And the wand had more problems getting a good read than other wand units. For most code sizes, we had to move the MiniBar wand

PC MAGAZINE FACT FILE



MiniBar
Barcode Industries Inc.
Ammendale Technology Park
12240 Indian Creek Ct.
Beltsville, MD 20705
(301) 498-5400
List Price: $585 for decoder box, Bar Code Bar Pen 40 LED red wand, and cables; $590 for decoder box, Mag Scan 65 Scanner Stripe reader, and cables; Mag Scan 65 Scanner stripe reader, $145.
Requires: IBM PC, XT, AT, or compatible.
In Short: The MiniBar system includes most of the parts necessary for typical bar code reading applications and configures many ways. Unfortunately, its performance ranks it below many other units tested.

CIRCLE 001 ON READER SERVICE CARD

If You Could Input Anything Into Your Computer Instantly, Without Using The Keyboard, Would It Make Your Life Easier?



Introducing DeskScan 2000. The affordable scanner from Chinon.

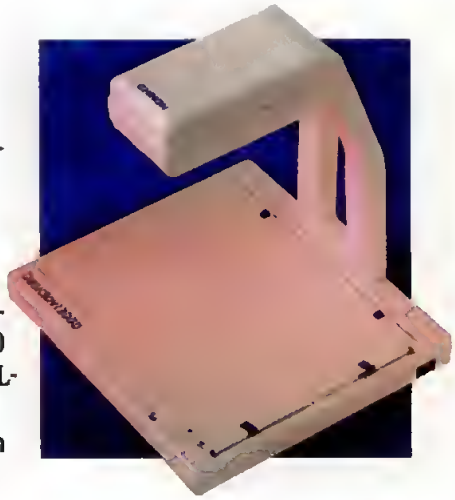
Chinon's unique new scanner could change forever the way you use your computer. With OCR software, it scans, digitizes and inputs text into your computer so that you can edit it with almost any word processing software. That means no more retyping of documents. Just think how much time that could save you and your staff!

DeskScan 2000 also scans images, so that you can input graphics too. Then you can manipulate these images with desktop publishing or graphics software.

Best of all, DeskScan 2000 is much lower priced than most effective scanners. That means it's finally cost-effective to put a scanner on every PC user's desk.

DeskScan's unique overhead scanning design means that you no longer have to separate pages from documents to feed them through a scanner. The document stays still while the scanning head *"reads"* the page. And the unit automatically adjusts for room lighting levels.

Scanners aren't just for desktop publishing any more. DeskScan 2000 becomes an economical FAX, with the simple addition of an inexpensive add-in board. Chinon sells this exciting option and others in package combinations of bundled hardware and software—so that you have an affordable way of getting started with your scanner right away.



So see for yourself what DeskScan 2000 can do for you. Call TOLL-FREE 1-800-441-0222 TODAY for the DeskScan 2000 dealer nearest you.

CHINON

Chinon America, Inc., 660 Maple Ave., Torrance, CA 90503

CIRCLE 318 ON READER SERVICE CARD

very quickly and program the density setting at a very high level.

The wand had a noticeably hard time reading low-density code. After several attempts, it took a very fast read to scan successfully the low-density code on a Federal Express bill; it could not read code on an aluminum can at all. According to the vendor, the average time between failures is 15,500 hours of actual use.

The user manual, however, is a model for this industry. The small, 84-page, wire-bound volume is beautifully typeset and includes relatively brief but clear instructions for installing, using, and programming the system.

Barcode Industries' hardware comes with a 1-year warranty on parts and labor. After that period of time, a service contract is available at 10 percent of the original purchase price per year. While the first line of support for users is through dealers or third-party vendors, Barcode Industries also provides support at no charge.

The MiniBar definitely gives you a lot for its low price but, again, its performance didn't match that of other units we tested.—**Greg Alwang**

COMPUTER IDENTICS

Scanstar PC Bar Code Reader

The Scanstar PC, from Computer Identics, is a wedge-style bar code reader that operates with wands, laser guns, and slot readers. The basic package, which costs $475, consists of a decoder unit, a power pack, an interface cable to connect the PC keyboard port and the decoder, and a user manual. The unit that we tested included an optional LED red wand, which costs an extra $169.

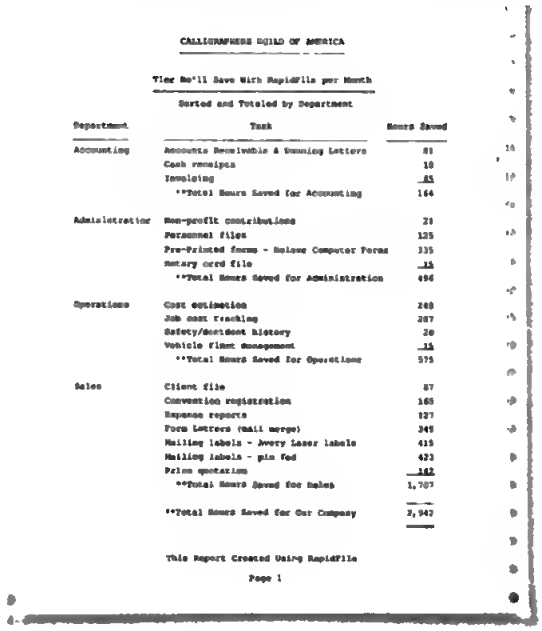
The Scanstar is intended to be an all-around bar code reading device. Quality assurance, parts and inventory tracking, and file access and updating in the insurance industry are some of its possible applications. (The vendor estimates there are five to ten units at the average site.)

This reader can decode 14 widely used bar code symbologies. The unit's default setting is to read nine codes, but you can add the other five by using setup menus, which are bar code labels in the manual. You set all parameters by scanning these menus, so you don't have to deal with any confusing and hard-to-use switch settings.

If you want to change, for example, such configuration parameters as baud rate, parity, serial port enabling/disabling, beeper volume, or terminating characters, you can first scan the setup label in the manual and then scan the appropriate settings.

Using the Scanstar is easy: just draw the wand over the code. The unit automatically discriminates among bar code symbolo-

Rapid lists. Rapid labels.



CALLIGRAPHERS GUILD OF AMERICA

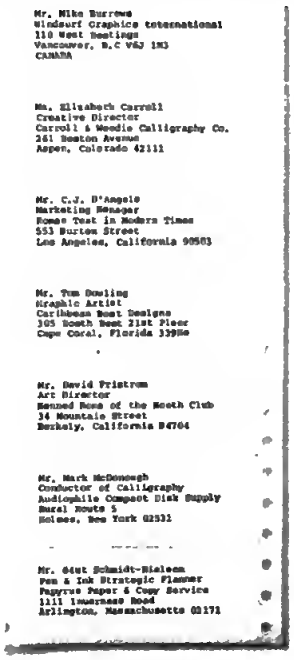
Time We'll Save With RapidFile per Month

Sorted and Totaled by Department

Department	Task	Hours Saved
Accounting	Accounts Receivable & Running Letters	81
	Cash receipts	18
	Invoicing	45
	**Total Hours Saved for Accounting	144
Administration	Non-profit contributions	21
	Personnel files	125
	Pre-Printed forms - Reduce Computer Forms	335
	Notary card file	15
	**Total Hours Saved for Administration	496
Operations	Cost estimation	248
	Job cost tracking	287
	Safety/Accident History	20
	Vehicle fleet management	15
	**Total Hours Saved for Operations	575
Sales	Client file	87
	Convention registration	165
	Expense reports	127
	Form Letters (mail merge)	349
	Mailing labels - Avery Laser Labels	415
	Mailing labels - pin fed	423
	Price quotation	142
	**Total Hours Saved for Sales	1,707
	**Total Hours Saved for Our Company	2,942

This Report Created Using RapidFile

Page 1



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Marketing Manager
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gies, beeping when it reads a code successfully. You can input or edit data manually from the keyboard at any time as well.

The product also has an auxiliary asynchronous serial port for reading input from portable bar code readers and other devices, such as an ASCII terminal.

The reader did very well on our tests. On most tests it read all the samples on the first try, with the usual difficulty handling extremely dense code. Performance with dot-matrix-printed code was exceptionally good. The Scanstar worked well with the wand held at different angles, from 90 degrees down to 30 degrees, and it had no trouble at all reading through shrink-wrap.

The Scanstar comes with a much better user manual than most bar code reader systems. It is typeset, well written, and clearly illustrated. The manual covers installation, operation, programming, options, and maintenance and repair of the unit and includes tables and appendixes with reference and technical information.

Computer Identics offers a 90-day warranty; after that, you can subscribe to a maintenance plan at $6 per month. An applications support team helps customers with problems at no charge.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE



Scanstar PC Bar Code Reader
Computer Identics
5 Shawmut Rd.
Canton, MA 02021
(617) 821-0830
List Price: $475, including SSPC decoder box, power pack, and interface cable; digital light pen, $169.
Requires: IBM PC, XT, or compatible.
In Short: The Scanstar PC is a keyboard wedge-style reader that recognizes 14 bar code types and is programmable with a features and parameters setup menu. An extra serial port is included to add other output devices.

CIRCLE 330 ON READER SERVICE CARD

Rapid letters. Rapid File.

Calligraphers Guild of America
22 William Penn Avenue • Pittsburgh, Pennsylvania 90002

March 1, 1988

FIRSTNAME MEMBERNAME
TITLE
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CITY, STATE ZIPCODE

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Best of all, RapidFile 1.2 now has a 80,000-word spelling checker, a 470,000-word thesaurus and 12 new ease-of-use features.

And if we have more power, we now move up to dBASE IV with Ashton-Tate's special RapidFile upgrade pricing.

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Sincerely,

William Ballpoint
Guild President

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Ashton-Tate logo/ Ashton-Tate Corporation; Lotus, 1-2-3/Lotus Development ©1988 Ashton-Tate Corporation. All rights reserved.

CIRCLE 519 ON READER SERVICE CARD

At $475, not including a wand or other reader, the Scanstar PC is a bit more expensive than many other units. Nevertheless, its ease of use and programming, the number of code types it reads, its reading performance, and the extra serial port combine to make it a good value, especially for use in a setting that handles many code types in a variety of applications.—**Greg Alwang**

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CIRCLE 478 ON READER SERVICE CARD

CONTROL MODULE INC.

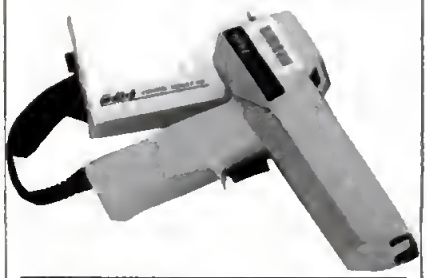
Control Module Model 1374 Bar Code Reader

The Model 1374 system, from Control Module, is an example of a common phenomenon in the PC market: a good product that seems difficult because of poor documentation. That problem aside, the system has a lot to recommend it.

The $445 base price of the Model 1374 for wand scanners includes only the interface box and cables. For an additional $177, you can get a medium-resolution wand (which we tested) or a high-resolution wand for $190. If you plan to use the Model 1374 with a laser gun, the base price is $495.

To program the module, you pass the wand over a "Bar Code Programming Menu," which actually consists not of a menu but of several bar codes representing certain parameters. These parameters re-

PC MAGAZINE FACT FILE



Control Module Model 1374
Bar Code Reader
Control Module Inc.
380 Enfield St.
Enfield, CT 06082
(203) 745-2433
List Price: $445 for Model 1374 interface unit with RS-232 auxiliary input port for use with wands; Feature 2910 wand, medium resolution, $177; Feature 2910 wand, high resolution, $190. $495 for Model 1374 interface unit with RS-232 auxiliary input port for use with laser scanners.
Requires: IBM PC, XT, AT, or compatible, or Zenith 248.
In Short: A versatile modular system that ties directly into the PC keyboard. Useful despite its documentation and strange programming interface.

CIRCLE 600 ON READER SERVICE CARD

Insist on a Sysgen 5¼" drive for your PS/2.

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A Sysgen™ Bridge-File™ gives a PS/2™ full access to your current data and software, with unparalleled 5¼" disk drive performance and reliability. You get: A larger capacity drive. Two modes — a 360Kb and a powerful 1.2 Mb — assure you comprehensive transfer capabilities and convenience for total office needs. Others, like IBM®'s, offer only 360Kb. Proven reliability. In fact, Sysgen is the choice of over 100,000 satisfied Bridge-File and tape back-up users. No slot loss. The Sysgen 5¼" drive adapter card doesn't take any additional slot space. IBM's does. Built-in flexibility of an external connector. You can add another Bridge-File drive or Sysgen's high-performance tape back-up system, Bridge-Tape.™ (As a Bridge-File owner, you receive a total savings of $135 on Bridge-Tape!) What's more, Sysgen's footprint is smaller. A full 50% smaller than IBM's. For the best PS/2 access to 5¼" disks, and the best value at only $325, insist on Sysgen Bridge-File.



Sysgen offers the only complete family of data transfer products: Including the 3½" Bridge-File floppy disk drive, for transferring information from any PS/2 to any PC. And the Bridge-Tape subsystem that's PC and PS/2 compatible, giving you total tape back-up and data transfer flexibility.

Call for Sysgen literature or for the location of the Sysgen dealer nearest you.

INFO HOTLINE 1-800-821-2151

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CIRCLE 173 ON READER SERVICE CARD

main stored in the interface module, even with the power off, until you change them.

A programming session begins when you scan the Start bar code. Then you can enter up to three bar code types, the code length, auxiliary port parameters, and beep level. Clone/compatible users can select one of three terminal types; there are also settings for serial ASCII entry, including baud rate, parity, and data bit.

In addition to these choices, the Model 1374 lets you program up to seven different data formats (or, as Control Module calls them, message formats). For example, to create sequential ASCII codes for a database entry (with text entries separated by two commas), you can program the unit to strip off the commas and suppress the carriage returns after reading the code. Similarly, you can add prefixes—tabs, spaces, or any other ASCII code.

The documentation, however, is of little help in this area. The manual does tell you what to do, but it gives no sample settings for spreadsheet or database entry, and no recommended settings for the novice.

The wand reader performed quite well, once I grew accustomed to it. The lightweight wand is easy to hold, but its skimpy, partly coiled 30-inch cord makes it impractical if you want to move any distance (the best I could achieve was 4 feet). And managing a workable angle becomes tough with the cord pulling from the top. You might increase the distance using a wand or keyboard extension cord, but that seems a rather slapdash solution.

The Control Module system also includes two optional hand-held laser guns, an 8-inch pistol and a smaller 4-inch version (both have the same short cord as the wand). The smaller gun features a dual-action trigger: the first click fires a small spot for aiming, the second scans and reads the bar code. The larger gun scans directly, leaving little room for error. Both guns take a bit more getting used to than does the wand, but they're also more fun.

I set up my own bar code shooting gallery to test maximum distances, distortions, and the like. The larger gun can read codes about a foot away, when positioned at angles from approximately 30 to 90 degrees. As one might expect, the greater the distance and the lower the angle, the fewer successful scans.

Still, I got some reads at much lower angles, though the smaller gun seems less tolerant of such variations. Both guns generate 4- to 8-inch rasters, depending on their distance from the scanning area.

All three scanners beep on a successful read but produce no sound on a miss. The wand produced the fewest misreads of all; in the shooting gallery, the smaller gun

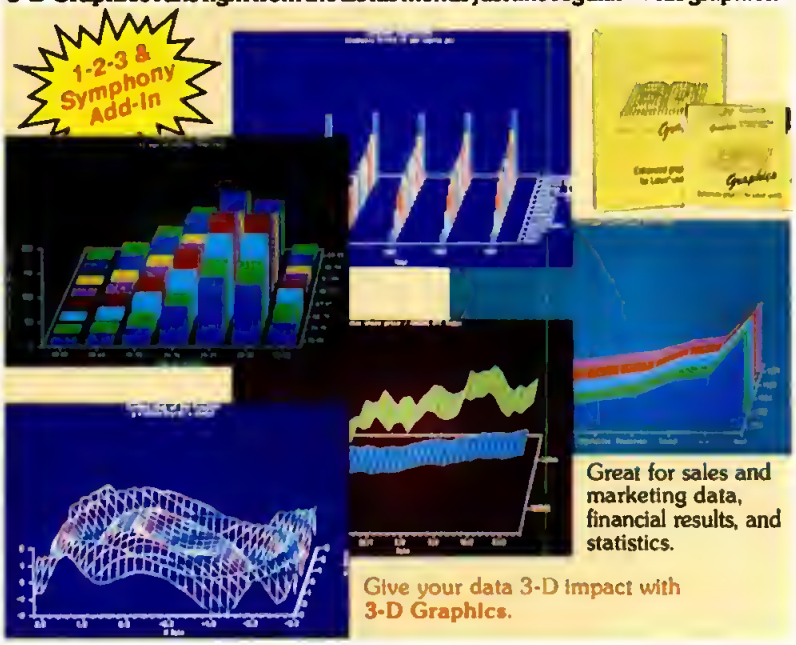
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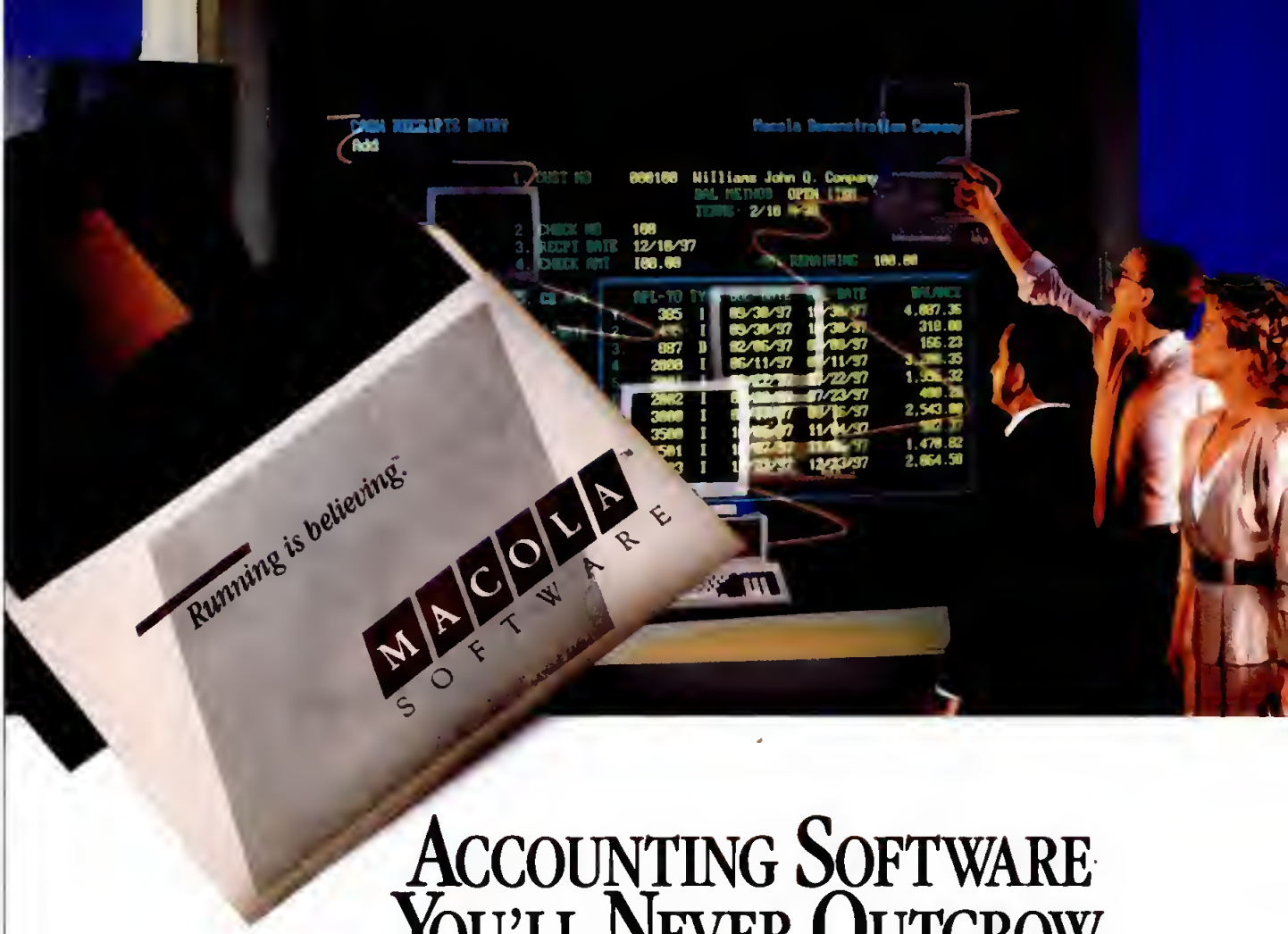
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CIRCLE 263 ON READER SERVICE CARD

was the winner. It's lighter, better balanced, and allows for aiming, whereas the larger pistol is tiring for extended periods and fickle in its aim—even with practice. While the only advantage of the larger pistol is a much thinner raster focus, my tests showed no difference in performance.

Control Module has a nice, modular product line that should answer most bar code scanning needs. Although the programming card is unique and marginally convenient, what would have been handy is the ability to download parameters directly from the PC, particularly for scanning a variety of codes.

More serious drawbacks are the cord lengths (too short for anything other than desktop usage) and the shoddy documentation. Correcting these flaws would make Control Module's bar code readers exceptional instead of merely satisfactory.—**Tom Stanton**

DATABAR CORP.

Databar DBR 801 Databar 4550 Keyboard Emulator

The Databar DBR 801, which sells for $750 with display and $600 without, and the $178 4550 Keyboard Emulator combine two styles of bar code reader. Together they are a wedge system that hooks up between a PC or other computer with an RS-232 port and its keyboard, and also a standalone, portable unit that first gathers and later dumps information to the computer.

If you want to use the unit as a portable, all you need is the 4550 terminal, its power supply, and the wand. The terminal has a 2K buffer that holds data until you connect it to a computer to load the information. It isn't battery operated, so it must be plugged in at all times or you will lose all saved data.

There is a small LCD screen on the terminal to display captured lines of code. If you use the buffered mode, you can scroll the lines to check scanning accuracy. The terminal can also plug directly into a computer's serial port, circumventing the wedge. And if your space is tight, using the system as a portable is much more advantageous.

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Even its price tag is lean. For only $1,990* you get the HP ScanJet scanner, interface kit and Scanning Gallery software. And for just $595 you can add ReadRight software and get a complete image and text system. For more information, call 1-800-752-0900, ext. 902A and ask for the HP ScanJet Pack.

* Suggested U.S. list price

HEWLETT PACKARD

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The unit includes two option control cards with scannable bar code control settings. Some of the options you can set are turning the buffer on and off and dumping the buffer, baud rate, and carriage returns at the end of codes. The control setting codes are also printed in the manual, and extra cards are available through Databar customer service.

The Databar automatically determines the type of code that it is reading without any programming and permits keyboard entry and editing when used as a wedge. The unit beeps to inform the user of accurate scans.

When tested, the Databar system operated very well; it read most of the codes in our tests on the first pass, with its lowest scores occurring on the highest-density test code. Compared with other readers, it read the dot-matrix-printed code poorly. The Databar read fine code that was covered with shrink-wrap and worked equally well with code wrapped around curved surfaces. However, it would not read silver-on-white code printed on a Coke can. The wand works at a wide range of angles, and the 64-inch cable allows a fair amount of movement.

The Databar's user manual comprises six 8½- by 11-inch pieces of paper stapled together. Don't let its appearance fool you, though; the descriptions and instructions are clear and informative and include tips for getting the best performance from the unit.

Databar sells mostly to systems integrators who package the Databar hardware with software and perhaps other hardware for specific applications. The company does sell some units directly to end users, though. The unit was designed for work-in-progress or other stationary applications such as tracking parts in an assembly process, but the systems integrators determine the actual uses of these readers by the way they package them.

The Databar unit and terminal have a 90-day return replacement warranty with shipping paid one way. After the warranty expires, parts and labor are charged at cost; however, the vendor says that there are few problems and that the system should operate for up to 4 years without failure. While the systems integrators who actually sell the units provide most first-level support, Databar does offer free technical support via an 800 phone number.

The Databar system's main advantage is its configuration flexibility. Because it can work as a serial input device or as a keyboard alternative, it has a wide range of applications. The standalone mode is especially appropriate for settings in which a data-capturing device collects the buffered input at a later time.—**Bruce Brown**

PC MAGAZINE FACT FILE



Databar DBR 801
Databar 4550 Keyboard Emulator
Databar Corp.
10125 Crosstown Circle
Eden Prairie, MN 55344
(612) 944-5700
List Price: DBR 801, $750, including pencil wand, RS-232 cable, Option control cards, power supply, and display; DBR 801 with all of the above but without display, $600; 4550 Keyboard Emulator, including cabling, $178.
Requires: IBM PC AT or compatible or serial port in any computer.
In Short: The Databar DBR 801 with the 4550 Keyboard Emulator is a flexible bar code reading system that can be used as a standalone, as a keyboard wedge, or plugged into a serial port. The system is programmable via scannable control commands.
CIRCLE **688** ON READER SERVICE CARD

DATALOGIC OPTIC ELECTRONICS

Datapen DP-0107

Datalogic's Datapen DP-0107 is a wand-type reader for use with PCs, XTs, and ATs that is simple to set up and operate. You can use the $520 system with a number of different wands offering a range of resolution, including 6, 8, 10, and 15 mils, or a laser gun. We tested the system with the 8-mil P30 wand.

The Datapen system we tested consists of a metal wand and a squarish, beige plastic base with two connectors: a DIN connector for your computer's keyboard, and a 9-pin D-connector for the wand cable.

The wand has a smooth stainless-steel housing, and you can leave it standing in a hole in its base. The coiled wire cable leading to the base is of a relatively heavy gauge, and the coils were somewhat difficult to stretch. The length of the cable from the base to the computer was adequate, and the unit was comfortable to use.

When you turn on the power for the system, the base of the unit emits a burst of three beeps, followed a few seconds later by three more. This is the signal that the installation is successful: you are now ready to go.

The Datalogic device has enough smarts to figure out whether it is hooked up

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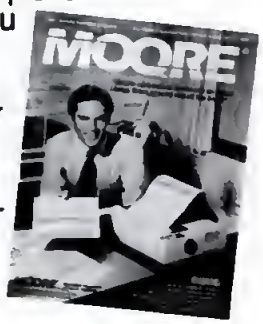
Datapen DP-0107
Datalogic Optic Electronics
301 Gregson Dr.
Cary, NC 27511
(919) 481-1400
List Price: $520 for DP-0107 interface unit and P30 wand.
Requires: IBM PC, XT, AT, or compatible.
In Short: Easy to set up, tricky to use, but capable of reading poor-quality codes, the Datapen is a good choice as long as you don't have to refer to the manual.
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to a PC or an AT and configures itself accordingly. If your PC compatible isn't close enough to the real thing for this to work properly, you can use the wand to reprogram the unit in various ways by reading four bar codes on a sticker beneath the base in various sequences. In this way you can force the system to work as either an AT- or an XT-style device, depending on your clone.

Since the datastream enters the computer as if it were coming from the keyboard, you should be able to use the Datapen with almost any application. I was even able to dump the scan results directly into *XyWrite III*, even with its default and fussy keyboard driver loaded.

The unit has a great deal of power and flexibility. The reader will automatically read EAN/UPC, Code 39, Interleaved 2 of 5, and Codabar. You can program the reader to read a total of 16 different codes, as well as add carriage return and/or line feed characters and specific "preamble" and "postamble" characters. A new model, which will be available by the publication date of this review, will be able to auto-discriminate among all 16 code formats.

The Datapen performed the tests accurately. It did not decode or drop check digits, and sometimes it added a leading zero. The wand itself was temperamental and sensitive to changes in reading angle. While the unit was able to read only one of the substandard-sized codes (out of 30 chances), it did an excellent job on the dot matrix bar codes.

The Datapen's only flaw is its manual, which is rather difficult to decipher. The first half is printed in Italian; the second half is an English translation of sorts. Unfortunately, some passages come out like the following section on programming keyboard sequences:

"Note: it's not necessary that they are different between them. In case of one or more of these are not successively used, the same sequence can be repeat of them."

The fact that the manual is printed in faint 9-pin dot matrix text in draft mode does not make the information any more accessible. However, according to a Datalogic representative, a new manual will accompany the new model.

Overall, the Datapen looks like a winner for straightforward scanning of common formats, especially when the labels are hard to read. It is a little more difficult to use than others in terms of its requirements for precise reading angle, but it did an excellent job of reading the poor-quality dot matrix codes.—**Alfred Poor**

INDUSTRIAL COMPUTER SOURCE

ICS BCS-150

Industrial Computer Source comes to the rescue of users who don't have a spare port for a serial device with its $495 BCS-150 bar code reader. The BCS-150 performs a bit of I/O sleight of hand while your computer is not looking.

The business end is familiar: a slim, polished steel wand reader. Instead of plugging it into a serial port, however, you attach the 9-pin D-connector to the back of a special half-length 8-bit expansion card that comes with the package and fits in a standard PC slot. Unfortunately for PS/2 owners, no Micro Channel version is currently available.

The magic is in the card: a serial port that comes with a standard 25-pin connector in addition to the 9-pin one, but is neither a COM1 nor a COM2 port. Instead, it is a special port that runs with the accompanying ICS software and tricks the computer into thinking that any data that comes through it really came from the keyboard instead of from a serial port.

Installing the reader took just a few minutes. The factory default settings choose the wand port, an interrupt request 2 setting, and other options. If some other device is used, the 25-pin connector can be configured as an RS-232C, a 20-milliampere current loop, or an RS-422 interface, depending on the device's requirements.

You can override almost all the switches, aside from configuring the port itself, with utility software. By adding parameters to a setup program, you can easily turn the reader's beep on and off, select which codes it will read or ignore, and more. This definitely beats pulling the top off the computer to change settings. There is also an option to report a code letter at the start of each reading, to indicate which bar code has been recognized.

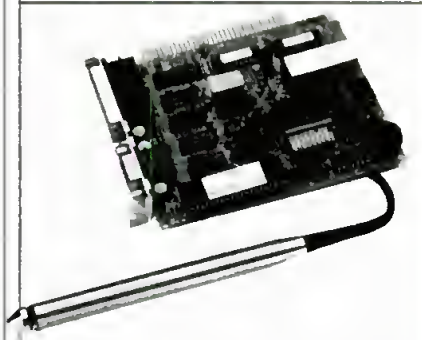
The reader did not handle the substandard, more-tightly packed codes well and performed only moderately well with the dot matrix codes. It read most of the code formats without changing the data as printed on the bar, but it did automatically expand the UPC E codes to an 11-digit code. The wand functioned at angles from 45 to 90 degrees.

The BCS-150 had one of the fastest response times of the readers that we tested. This reader seemed to scan faster and give the confirming beep sooner than the others. A speaker on the expansion card produces the beep, so a PC speaker is not necessary.

The cable from the card connector to the wand is rather short—26 inches—and a bit stiff, which may make it hard to use in some installations.

As for documentation, an excellent manual comes in a three-ring binder and

PC MAGAZINE FACT FILE



ICS BCS-150
Industrial Computer Source
5466 Complex St., #208
San Diego, CA 92123
(619) 279-0084
List Price: $495 for interface card, wand, and *Scan-Pak* example software; $695 for half-length, 8-bit interface card, wand, *Scan-Pak* example software, and *Print-Pak* and *Comm-Pak* firmware.
Requires: IBM PC, XT, AT, or compatible; 8-bit expansion slot; one floppy disk drive recommended.
In Short: Swift and slick, this reader relies on an expansion card that does not use up a serial port assignment. It is only average at reading poor-quality labels, but it is fast and easy to configure for reading others.
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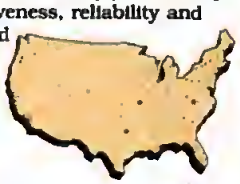
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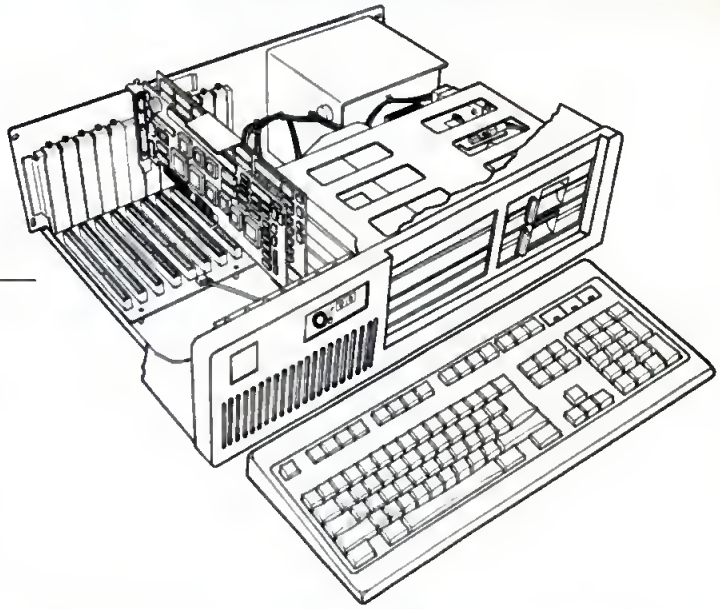
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*InfoWorld, December 1987

Hardware Specifications: Requires PC/MS-DOS version 2.0 or higher with 384K of usable memory and a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3½" media optionally available. Not copy protected

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covers all the configuration and operation options. It also explains the different programs and sample files that come with the unit.

The evaluation unit came with a range of utilities loaded in ROM on the card and on a separate disk. They perform such useful tasks as accepting input from any serial port as if from the keyboard, printing bar codes, and sending the codes read by the wand out to another serial port. For an extra $200, you can get *Print-Pak* and *Comm-Pak* for printing and communications options.

The BCS-150 is fast and effective, although when tested it was only moderately successful with the low-quality bar codes. For users with an open PC slot, the BCS-150 is a flexible and versatile package.—**Alfred Poor**

INTERNATIONAL TECHNOLOGIES AND SYSTEMS CORP.

PC-Wand

As you'd expect from its name, the $495 PC-Wand is a wand reader that installs between your PC and its keyboard. To tell the wand whether you have a PC or an AT keyboard, you set one of four DIP switches on a separate base unit. You next plug your keyboard and the wand into the base unit, then the base unit into the keyboard connector on your computer, turn on the PC, and you're in business.

The wand is a lightweight plastic model called the BP10, made by Unitek in Taiwan. Midway up the top side of the wand, there is a lozenge-shaped button, which you press and hold to activate the LED in the wand's tip in order to scan. On the whole, the wand feels lighter and easier to use than the metal models.

The PC-Wand was able to read the majority of the substandard bar codes. It was also relatively tolerant about the scanning angle, as long as the wand was not held vertically or past about 30 degrees. My only complaint was that there was a noticeable lag between the scan and the acceptance beep—though once I got used to the momentary delay, it was not a serious problem. The wand managed to read only one of the 30 codes printed with the dot matrix printer.

The reader scanned all the codes precisely as they were written on the page and did not decode or expand them. Check digits were reported intact, though in a few instances, the reader added leading zeros.

The PC-Wand recognizes four codes: UPC, Codabar, Code 39, and Interleaved 2 of 5. Since the unit had no automatic selection feature, I had to change a pair of switches whenever I changed code types. The switches are in the back of the bases and you can change them while the unit is on. This is not terribly convenient but is far better than having the switches inside a case.

According to an ITS representative, by the time this article is printed, the PC-Wand will be shipping with new internal hardware that will automatically recognize the four different code types. The base units will continue to have the switch blocks, but the switches assigned to code selection will no longer be functional.

The PC-Wand is accurate for good-quality codes and is especially effective for compressed bars—though it had difficulties reading low-quality codes. But aside from this problem, the PC-Wand's price and ease of installation make it an attractive system.—**Alfred Poor**

PC MAGAZINE FACT FILE



PC-Wand
International Technologies and Systems Corp.
1950 White Star Dr.
Diamond Bar, CA 91765
(714) 861-7977
List Price: $495 for BP10 wand and emulator.
Requires: IBM PC, AT, or compatible keyboard connector.
In Short: Aggressive pricing, simple installation, and reliable performance make this an attractive product.

CIRCLE 685 ON READER SERVICE CARD

KD ASSOCIATES

CYC-IB

The $595 CYC-1B, from KD Associates (formerly New Wave Systems), tries hard to be the Hayes Smartmodem of bar code readers. Like the Hayes modem, the CYC-1B has built-in smarts in the form of a microprocessor-controlled command set. It's an alternative for those who abhor using DIP switches to change hardware settings.

The CYC-1B's command set consists of a few special bar codes, listed in the manual. Run the CYC-IB wand over the right code, and it will interpret the code instead of passing the code through to your computer.

One of the codes toggles the frequency of the reader's recognition signal between a high-pitched beep and a low buzz. The other codes tell the reader to end each bar code with a single carriage return, a double carriage return, or none at all.

The only flaw in this scheme is that it doesn't go far enough. The four codes listed above are the only command codes available. What's worse, no DIP switches supplement these choices. You are generally stuck with the factory settings for bar code interpretation.

In the performance tests, the CYC-IB read UPC A, Code 39, and Codabar exactly as they appeared on the printed page. It expanded UPC E. The unit does not read Interleaved 2 of 5, but it automatically recognizes the codes it can read.

The CYC-1B performed no better than adequately on the performance tests. Like many readers, it could not read the "tiny" samples (far smaller than specifications call for) or the dot matrix samples (specially printed as poor-quality output). Unlike most readers, however, the CYC-IB also had trouble reading UPC E.

On UPC A, Code 39, and Codabar, the CYC-IB performed well in horizontal orientation, vertical orientation, reading right to left, and reading in a curved sweep. It did not perform well reading through shiny

plastic, or reading on a curved surface. If the bar codes you need to read are limited to UPC A, Code 39, and Codabar on flat, unshiny surfaces, you won't have any problems.

Like other bar code readers that plug into a computer through the keyboard connector, the CYC-1B is easy to set up. The unit is 4 inches wide by 5 deep by 1½ high, with two connectors in the back and one DB-9 connector in front.

The wand that comes with the CYC-1B has a size and shape that is more like a fat highlighter than a thin pen. The nonslip plastic surface is both lightweight and comfortable to hold.

Unfortunately, the CYC-1B is picky about angle. It will read from angles that range from nearly perpendicular to those that are about 35 degrees. As the manual points out, though, the best reading angle is between 10 and 20 degrees—a little awkward for holding the wand the way you would hold a pen.

The only truly inferior part of the package is the manual, which is hardly worth having. It lacks some important information, such as the fact that the unit works only with an AT, and it is occasionally misleading. The introduction, for example, implies that the unit reads Code 39 only. A KD Associates representative told us that a new manual has been in the works; it may well be ready for shipping by now.

The company also sells *BarGen*, a software program that enables you to print your own Code 39 bar codes. *BarGen* works on any printer with Epson-compatible graphics. The company discourages creating other kinds of bar codes on dot matrix printers, because it has found that such bar codes do not match standards.

KD Associates bills its product as a general-purpose unit, designed for any application that's based on a PC. This characterization is appropriate, but keep in mind that the CYC-1B has no options for modifying the interpretation of bar codes. Be sure that the built-in choices are the ones you want. And remember, the appeal of having no DIP switches to set is also offset by the low read rates and the 10- to 20-degree read angle required for the wand.—**M. David Stone**

PC MAGAZINE FACT FILE



CYC-1B
KD Associates
13115 Washington Blvd.
Los Angeles, CA 90066
(213) 475-8545
List Price: $595 for CYC-1B interface unit, wand, and cables.
Requires: IBM PC, AT, or compatible (versions for IBM PC, XT, and compatibles also available for same price).
In Short: The CYC-1B offers an innovative way to change its settings—by reading bar codes that the unit interprets as commands instead of as data. Unfortunately, the commands provide few options for modifying data interpretation.
CIRCLE 682 ON READER SERVICE CARD

MSI DATA CORP.

Datawand II
Datawell II

Bar code readers include any number of devices called wands, but none deserve the name more than the $495 Datawand II from MSI Data Corp. Somewhat stubby by a sorcerer's standards, the 2.2-ounce Datawand II looks like the handle from a small electric toothbrush: 7 inches long by about 1 inch in diameter at its widest point. Built in to the unit are 8K of data memory, rechargeable batteries, and firmware for recognizing bar codes.

The Datawand II is extremely portable: a penlike clip can hold the wand to your shirt pocket. Survivability is always an issue with anything this portable; the Datawand II doesn't look rugged, but dropping it several times in testing did no harm. An MSI Data representative says the unit is designed to be rugged enough for typical bar code reading environments.

When you're not using the Datawand II for reading bar codes, you can leave it in the Datawell II ($240). Not much larger than the inkwell its name suggests, the Datawell recharges the Datawand's nickel-cadmium battery and provides a connection to your PC. The communications cable on the Datawell ends in a DB-25 connector suitable for plugging into either a modem or a null-modem cable for direct connection to your PC.

Using the Datawand II is only slightly more difficult than plugging in the Datawell II. The unit has a repertoire of built-in settings that bar code commands can change. MSI Data provides the commands on two plastic-coated cards. The system card, which fits in a three-ring

PC MAGAZINE FACT FILE



Datawand II
Datawell II
MSI Data Corp.
340 Fischer Ave.
Costa Mesa, CA 92626
(714) 549-6000
List Price: Datawand II, including Operator Command Card, $495; Datawell II, including RS-232 cable and a power supply, $240.
Requires: IBM PC, XT, AT, or compatible; serial port.
In Short: The Datawand II makes it easy to scan with little or no practice. Its small size and light weight, combined with 8K of memory, make it an attractive choice for applications where extreme portability is an important consideration.
CIRCLE 684 ON READER SERVICE CARD

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CIRCLE 363 ON READER SERVICE CARD

binder, enables you to set parameters that rarely change in the field, such as communications settings. The second card, small enough to fit in a shirt pocket, has the kind of heavy-duty clip found on security badges and contains those commands you are likely to need in the field, such as a command for resetting the wand so that a right-to-left scan will delete a bar code rather than add it.

Using the Datawand II involves little or no learning curve. In *PC Magazine*'s tests, the unit scored high first-read rates on every code it read, including UPC and Code 39. Most notably, it was one of the few units that performed well on curved surfaces and one of the few that could read at least some of the poor-quality dot matrix samples.

The unit did not read any of the "tiny" samples in our tests. Nor did it read any of the Interleaved 2 of 5 samples. According to an MSI Data representative, the Datawand II is designed to be much less tolerant of out-of-spec bar codes for Interleaved 2 of 5 than for other codes. Interleaved 2 of 5 is relatively easy to misread, and the "tight" algorithms help guard against mistakes. In addition to the bar codes we tested, the Datawand II reads EAN and the MSI/Plessey bar codes.

To move the data to your PC, you have to connect the Datawell II to your system, either directly or by modem. MSI Data offers a communications program for the PC side but did not provide it for this review. *PC Magazine*'s tests transferred the data to *ProComm*.

Data transfer is simple. After establishing communications between your PC and Datawand, you must only scan the "transmit" code on the command card and insert the Datawand into the Datawell. The unit acknowledges successful connection and transmission both visually, with the LED, and audibly, with a beep.

The Datawand II adds its own information to the bar code data; each data file starts with a header that includes a time stamp. The unit also surrounds each bar code with additional information, including the results of a Longitudinal Redundancy Check calculation for error-checking the transmission. The error-checking information is meant for use with MSI Data communications software. You can't strip it out when using a program like *ProComm*.

As with any bar code reader that sends information to your PC as a file, you must have some way to feed the data into your database program. The additional information does create a minor problem, since you first have to strip the unwanted information out.

According to MSI Data, the Datawand II is intended for applications such as market research, file folder tracking, patient history records, and other uses where small size is critical. Certainly, the Datawand II's extremely light weight, portability, ease of use, and ability to read well on curved surfaces make it an attractive choice for use in the field.

—M. David Stone

NEWER TECHNOLOGY

Sceptre

The Sceptre bar code reader, $450 from Newer Technology (or $850 with slot reader), offers impressively good first-scan reliability along with ease of use and ease of installation. If you're looking for immediate gains in productivity, this combination is hard to beat.

The package includes an interface board, a wand, and software. The board is suitable for an IBM PC, XT, AT, PS/2 Model 30, or compatible.

Once the reader is installed, the computer treats any data that the wand reads as if it had been typed at the keyboard. As shipped, it will recognize standard Code 39, extended Code 39, Interleaved 2 of 5, and UPC/EAN/JAN codes. The software includes setup options to enable or disable each of these, and to enable or disable recognition of variations of UPC or UPC/EAN/JAN codes. For those codes that are enabled, all recognition is automatic.

In the performance tests with the default settings for the software, the Sceptre read exactly what was on the page for UPC A, Code 39, and Interleaved 2 of 5. It added a zero to the front of Codabar, and it expanded UPC E. A software-selectable option lets you pass checksum digits through or strip them out.

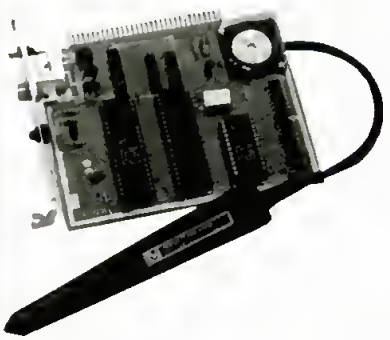
On first-read performance, the Sceptre ranks among the best. The unit could not read the dot matrix samples or the "tiny" samples, but it managed a first-read rate of 100 percent on nearly every other test.

Performance on a curved surface was particularly impressive. Most readers performed poorly on this test, but the Sceptre had a first-read score of nearly 100 percent on curved surfaces.

The Hewlett-Packard wand that comes with the Sceptre has several notable design touches. Made from plastic, it is apparently less durable than metal wands, but Newer Technologies claims a lower incidence of failure since switching to the plastic version.

This wand is also lighter than many metal wands. The light weight plus the slip-resistant surface and a shape that is closer to a fat highlighter than to a thin pen all combine to make the wand significantly more comfortable to use than most metal wands.

PC MAGAZINE FACT FILE



Sceptre
Newer Technology
1117 S. Rock Rd., #4
Wichita, KS 67207
(316) 685-4904
List Price: $450 for interface card, Hewlett-Packard HBCS2308 wand, and bar code software; $850 with slot reader.
Requires: IBM PC, XT, AT, or compatible, or PS/2 Model 30; one free slot.
In Short: Consisting of an interface card, wand, and software, the Sceptre will work in a PC, XT, AT, or compatible or a PS/2 Model 30. It offers high first-read rates with no learning curve, and one of the most comfortable wands to use. The software will let you use two bar code readers in one computer.
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CIRCLE 540 ON READER SERVICE CARD

The Sceptre is not particular about angle and will read well at any angle from perpendicular to about 45 degrees. We had no problems when holding the wand like a pen and found we could use it well from the beginning, with no learning curve.

Also adding to comfortable use of the Sceptre is the 8-foot coiled cord, which includes a 30-inch straight section between the coils and the wand. This section is long enough to let the cord reach easily around the right side of the system unit. More importantly, it lets you use the wand without tugging on the coils and having them tug back on the top of the wand.

One unusual ability of the Sceptre software is that it can handle two bar code readers in a single system. Bar codes read by the first wand are sent directly to your software. Bar codes read by the second wand are held in memory for later decoding. This feature is useful in high-volume applications.

A Newer Technology representative says that the Sceptre was designed as a general-purpose product—for inventory, point-of-sale, or any application that uses a PC for bar code reading. With its $450 price and good performance on PC Labs tests, the Sceptre is hard to beat.

—M. David Stone

PERCON (PERIPHERAL CONNECTIONS INC.)

E-Z-Reader

The $635 E-Z-Reader from Percon offers a solution for those who currently have an IBM PC or XT, but who are thinking of upgrading to an AT. If you're in that position, you might normally shy away from using a keyboard connection for your bar code reader.

One of the drawbacks of a keyboard connection is that the reader has to imitate exactly the keyboard scan codes for the computer to which it is attached. Unfortunately, these differ between a PC or XT on the one hand, and an AT on the other. And with most bar code readers that connect through the keyboard, upgrading your computer means you can't use your old bar code reader.

With the E-Z-Reader there is no upgrade problem. To move it from PC to AT, you only have to remove two screws to get inside the unit and then move one jumper. If there was ever a feature that should be widely copied by the competition, this is the one.

Installing bar code readers that plug in through the keyboard connector is usually a fairly effortless task, and the E-Z-Reader is easier to install than most. The unit consists of a 5- by 5¼- by 1½-inch box and comes shipped with the wand already connected. Once the system is installed, any bar codes it reads will go directly to your system, where they will be indistinguishable from anything that is typed at the keyboard.

The E-Z-Reader can read UPC A and E, Code 39, Interleaved 2 of 5, and Codabar. You can enable or disable its ability to recognize any of these codes by changing DIP switches inside the box. Similarly, you can turn auto-recognition of codes on or off.

In the performance tests, the E-Z-Reader stripped the last digits from UPC A and E and Codabar. For Code 39, it sent exactly what was on the page. It did not expand UPC E. You can change a DIP switch to pass the start and stop characters through to your system; all other data interpretation is fixed.

One complication for Interleaved 2 of 5 is that the DIP switches must be set for the specific number of digits in your bar codes. The unit would not read the Interleaved 2 of 5 test samples until we reset it for 12 digits. Since you have to open the box to reset the switches, the E-Z-Reader is a poor choice in the unlikely event that you want to use Interleaved 2 of 5 code in more than one situation with different numbers of digits. (The company said that the DIP switches on models shipped after November 1, 1987, will be the same except that the reader will be shipped in auto-recognition mode, with six-character Interleaved 2 of 5 label length.)

The E-Z-Reader would not read the "tiny" samples on the performance tests, but otherwise it did well on horizontal reads, vertical reads, reading right to left, reading through clear plastic, and reading with a curved sweep. It also read the dot matrix samples better than most other readers.

On a curved surface it read Code 39, Codabar, and Interleaved 2 of 5 well enough, but it had trouble with UPC A and E. The beep announcing a successful read is loud enough to be heard in a noisy environment.

The E-Z-Reader metal wand is smaller than most, measuring 5 inches long by about ⅜ inch in diameter. The manual suggests the best angle is 10 to 20 degrees, but in our tests it read successfully at angles that range from perpendicular to 45 degrees. In addition to the wand provided for review, Percon offers other choices, including higher-resolution wands, infrared wands, and slot readers.

The cable from the box to the keyboard connector is long enough to bring the box to the front of the PC. The 6-foot coiled cord on the wand gives freedom of movement anywhere near the PC. However, if you go more than 2 or 3 feet from your system, you risk pulling the box off your desk. This potential problem is solved by the Velcro strip that you can use to tack the box to the side of your computer.

The manual for the E-Z-Reader is one

PC MAGAZINE FACT FILE



E-Z-Reader
Percon (Peripheral Connections Inc.)
2190 W. 11th Ave.
Eugene, OR 97402
(503) 344-1189
List Price: $635 for bar code decoder and interface box with sealed light wand.
Requires: IBM PC, XT, AT, or compatible.
In Short: Of those bar code readers that plug into the keyboard connector, the E-Z-Reader is one of the few that can work with either the AT or the PC. It also offers more user-settable options than other keyboard connection units and an unusually good manual.

CIRCLE 681 ON READER SERVICE CARD

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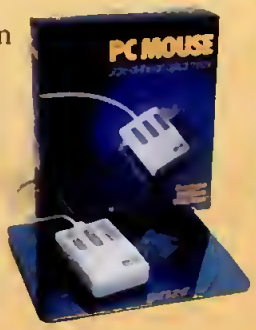
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Formerly Mouse Systems

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CIRCLE 350 ON READER SERVICE CARD

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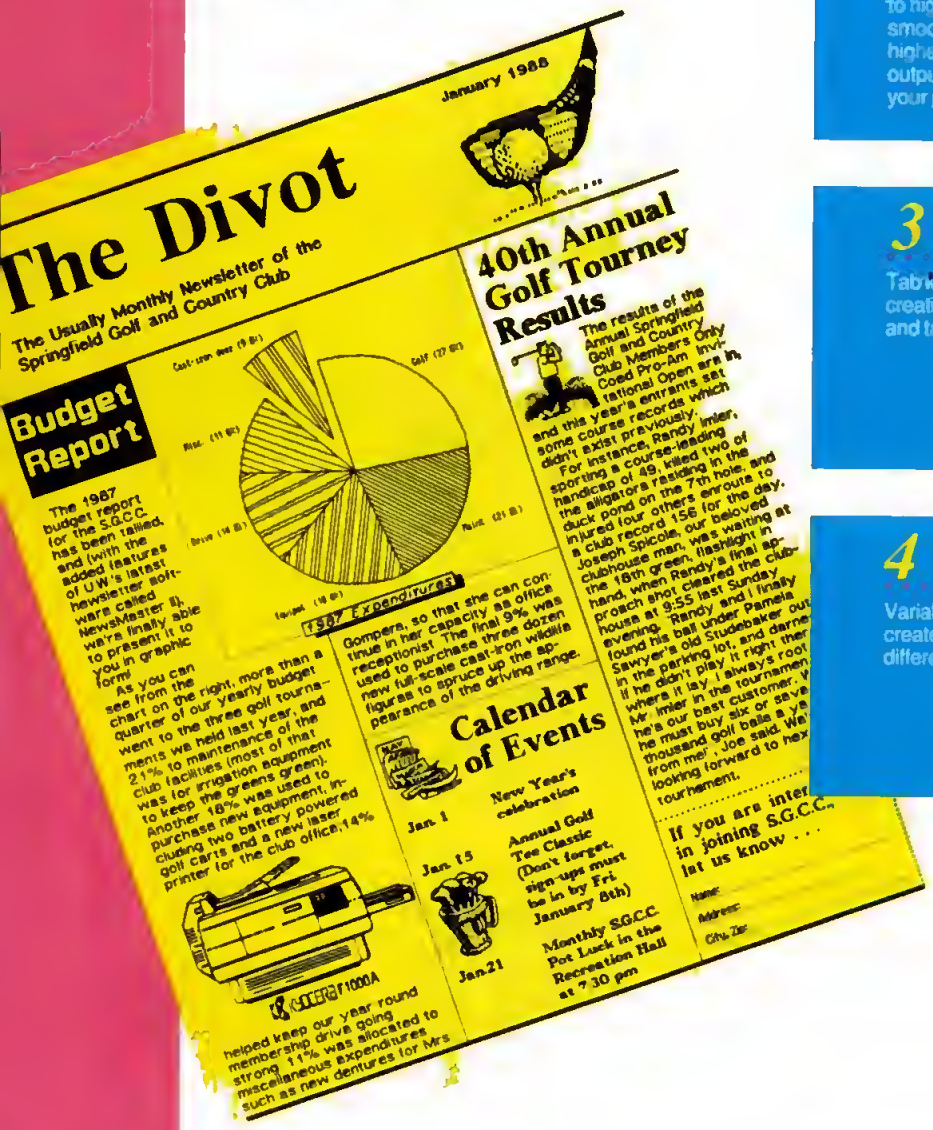
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CIRCLE 530 ON READER SERVICE CARD

NewsMaster II™

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of the best I've seen. Although it occasionally lapses into technobabble, it includes useful information such as how to hold the wand. Beginners will be far happier with this than with a manual that simply assumes they know what they are doing. Also, the E-Z-Reader comes with a 2-year warranty, and Percon promises 24-hour turnaround on all repairs.

By any measure the E-Z-Reader does its job well. It offers more user-set options than other keyboard-connection units, high first-read rates, and a wand that works well at a wide range of read angles. The additional ability to work either with a PC or XT or with an AT makes it a particularly good choice for PC or XT users who are planning a change to an AT in the future.—**M. David Stone**

SEAGULL SCIENTIFIC SYSTEMS

Seagull BCR-1000 Bar Code Reader

The BCR-1000, from Seagull Scientific Systems, consists of an interface board, software, and your choice of wand or laser scanner ($399 with one wand, $639 with the laser gun). It works in a PC, XT, AT, or PS/2 Model 30, as do other such packages.

Also, as with similar packages, installing the BCR-1000 is a simple matter of plugging the board into an empty slot, plugging the wand's or laser scanner's cable into the board, and installing the software. One handy addition is an installation program that automatically copies the bar code recognition software to your working disk or hard disk and adds a line to your AUTOEXEC.BAT file to load the software whenever you boot up.

The installation program also allows you to set various options. As shipped, the unit will read Code 39, Interleaved 2 of 5, Codabar, UPC A and E, EAN 13, EAN 8, and the EAN and UPC supplemental codes.

The software can enable or disable recognition for any of these codes. It can also set the BCR-1000 to add a carriage return for each code, compute the check digit, and pass the check digit to your computer.

Even better, the software can set the options for each code separately, so you can match the settings exactly to your needs. For UPC E, the software offers the option to expand the number.

Once you've installed the hardware and software, the BCR-1000 works along with the keyboard. The reader sends the data to your software, just as if you had typed it, and automatically recognizes each code that is enabled.

You can use either a wand or a laser scanner with the BCR-1000. The reader also offers a choice of wands, letting you pick the one that best serves your purposes. For these tests, Seagull supplied three different wands plus a laser scanner. Each of these can plug into the same board and use the same software without modification.

The three metal wands are outwardly identical; each is 5½ inches long and about ½ inch in diameter. The manual notes the best angle for reading is about 20 degrees. This is a little steep for holding the wand like a pen, but in my tests the wands managed to read bar codes at angles that range from perpendicular to a surprising 60 degrees. And holding the wand like a pen caused no obvious problems.

The 6-foot coiled cords on the wands are more than adequate to reach around the left side of the PC (where the board plugs in), but they are a little skimpy for reaching around the right side. The package also comes with a 5-foot extension cable, which is a bit too long for just reaching around the left side of the PC and tends to tangle. It can be useful, however, when you're reading bar codes some distance from the computer. The vendor can supply optional cables that are as long as 100 feet.

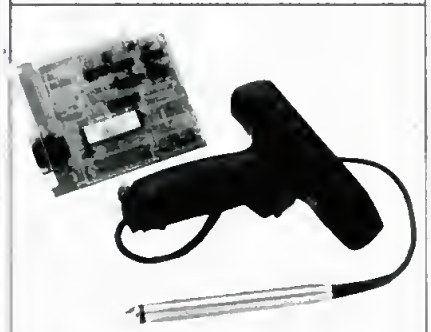
The three wands provided for review included a high-resolution visible-light wand, a medium-resolution visible-light wand, and a high-resolution infrared-light wand. The high-resolution visible-light wand is the wand of choice for reading small bar codes down to a minimum line width of about 5 to 5½ mils. It can also read lower-resolution bar codes, but it may misread poor-quality codes.

In the performance tests, differences among the wands were minor. All did a good job of reading the "standard," "smaller," and "large" testing samples on both white and red paper. All three were also able to read at least some of the dot matrix samples, with both visible-light wands managing better than the infrared wand. All did well in both vertical and horizontal orientations, on curved surfaces, with a curved sweep, and in a right-to-left read.

Each also managed reasonably high first-read rates when reading through clear plastic. The infrared wand was the best: the only one that scored a 100 percent first-read rate for all trials reading through the plastic.

The optional laser scanner, shaped like a gun, projects a visible red dot to help guide your aim and to help you maintain distance. The red dot indicates the correct distance by focusing on the surface at which you're aiming. It is smallest, with the most sharply defined edges, at just over 2 inches from the target.

PC MAGAZINE FACT FILE



Seagull BCR-1000 Bar Code Reader
Seagull Scientific Systems
601 University Ave., #150
Sacramento, CA 95825
(916) 386-1776
List Price: $399 for interface card, user support software, and high-resolution visible-red wand, medium-resolution visible-red wand, or high-resolution infrared wand; $639 for interface card, BCR-1000S hand-held laser diode scanner, and user-support software.
Requires: IBM PC, XT, AT, or compatible, or PS/2 Model 30; half slot.
In Short: Consisting of interface card, software, and your choice of wand or laser scanner, the BCR-1000 will work in a PC, XT, AT, or PS/2 Model 30 or compatible. The menu-driven setup software makes it easy to customize the bar code interpretation for your needs.
CIRCLE 680 ON READER SERVICE CARD

The laser scanner reads the bar codes most reliably at a distance of 2 to 4 inches, though it will work from about 1 to 6 inches. We found controlling the aim of the gun much more difficult than sweeping a wand across a bar code. This is not a problem with short bar codes, but it did become a problem with the "large" test samples, some of which were about 6 inches long.

In addition, keeping the dot from wandering vertically is difficult. It became a problem with the dot matrix samples, some of which were less than ½ inch high. In some cases we had to use our left hands to steady our right hands when holding the laser gun.

The performance of the laser scanner was notably different from that of the wands. For the "large" samples of Code 39, read rates dropped significantly because of difficulty in aiming the gun (aim may also be a problem when trying to move the gun over a curved sweep). For the "tiny" samples (smaller than specs), however, read rates increased from essentially 0 to a consistent 30 to 40 percent.

The BCR-1000 manual deserves special mention. Although short and to the point, it includes everything you need, including useful background information. Particularly welcome is a section on solving read problems.

For printing bar codes, Seagull Scientific Systems recommends its own package, *The Bar Tender*. It supports Epson graphics and, according to the vendor, it works with any dot matrix or laser printer that has an Epson graphics emulation mode. A LaserJet II driver may be available by the time you read this. *The Bar Tender* is $79 if purchased with a Seagull bar code reader, $129 if bought separately.

The combination of easily definable software options plus the choices in hardware makes Seagull Scientific Systems a strong possibility for one-stop shopping. The BCR-1000 is a good place to start your search for a bar code reader.

—M. David Stone

SYSCODE INC.

BarBoard

The BarBoard, $595 from SysCode, can be equally at home in your PC, XT, AT, or PS/2 Model 30. It's easy to set up, easy to use, and asks little of you other than learning the skill of scanning the bar codes.

As the name implies, the BarBoard package is built around an interface board; also included is a wand and software. In addition, the board will work with laser scanners, noncontact scanners, and slot scanners.

As with most other PC bar code readers, the BarBoard works as an adjunct to the keyboard when hardware and software are installed. Load your favorite software, and anything you scan will be fed into the program just as if you had typed it.

The standard version of the BarBoard will read Code 39, UPC A and E, EAN/JAN 8 and 13, Interleaved 2 of 5, and 0, 2, or 5 extensions of UPC. Nonstandard bar codes are options available at additional cost.

The BarBoard automatically recognizes the bar code it is reading. In PC Labs tests, the unit read exactly what was on the page for UPC A, Code 39, and Interleaved 2 of 5. It passes check digits through rather than stripping them out. For Codabar, the unit adds an extra zero in front of the number. It does not expand UPC E.

The BarBoard is marginally more difficult to use than other bar code readers, because it's more sensitive to speed. With most wands, it's hard to scan too fast. With the BarBoard, the percentage of first reads decreased noticeably with fast scan rates. We had to experiment to find the speed that worked best, then maintain the proper pace.

Once you have the speed right, the wand will read bar codes at angles from nearly perpendicular to about 45 degrees. The most reliable angles are 25 to 35 degrees, which translates into holding the wand the way you would a pen. The metal wand itself is 6½ inches long by ½ inch in diameter. The 6-foot coiled cord is long enough to reach items near the left side of your PC (where it plugs in) but barely makes it around the right side of the system unit.

On performance tests, the BarBoard managed better on horizontal than vertical reads, and it did poorly reading from right to left and reading on curved sweeps. It read none of the dot matrix samples and few of the "tiny" samples, nor did it read the Federal Express airbill.

On most tests the BarBoard had problems with UPC E, with first reads rarely topping 50 percent. One exception was the codes covered by clear plastic, for which the BarBoard did well on UPC A and E but poorly on the other codes. In reading from curved surfaces, it read UPC E better than anything else, but still not as well as some other units we tested.

According to SysCode, the BarBoard's algorithms for decoding are less tolerant of out-of-spec bar codes than are some of its competitors. This makes it more likely to ignore a given bar code, but less likely to read one incorrectly.

The BarBoard comes with software for printing bar codes on an Epson MX, RX, or FX series printer, or on the SysCode L300 laser printer (also sold as the Cordata L300). The software will let you print all variations of UPC, basic Code 39, expanded Code 39, and Interleaved 2 of 5 in your choice of code density.

The manual for the BarBoard is lean but useful. You won't find long discussions of

PC MAGAZINE FACT FILE



BarBoard
SysCode Inc.
350 S. Crenshaw Blvd., Suite A-102
Torrance, CA 90503
(213) 533-0992
List Price: $595 for interface card, digital wand-style scanner, and bar code software. $470 for board only.
Requires: IBM PC, XT, AT, or compatible, or PS/2 Model 30; one full-size slot.
In Short: Consisting of interface card, wand, and software, the BarBoard will work in a PC, XT, AT, PS/2 Model 30, or compatible. The "tight" decoding algorithms make the BarBoard less likely to read out-of-spec bar codes, but also less likely to misread data.
CIRCLE 679 ON READER SERVICE CARD

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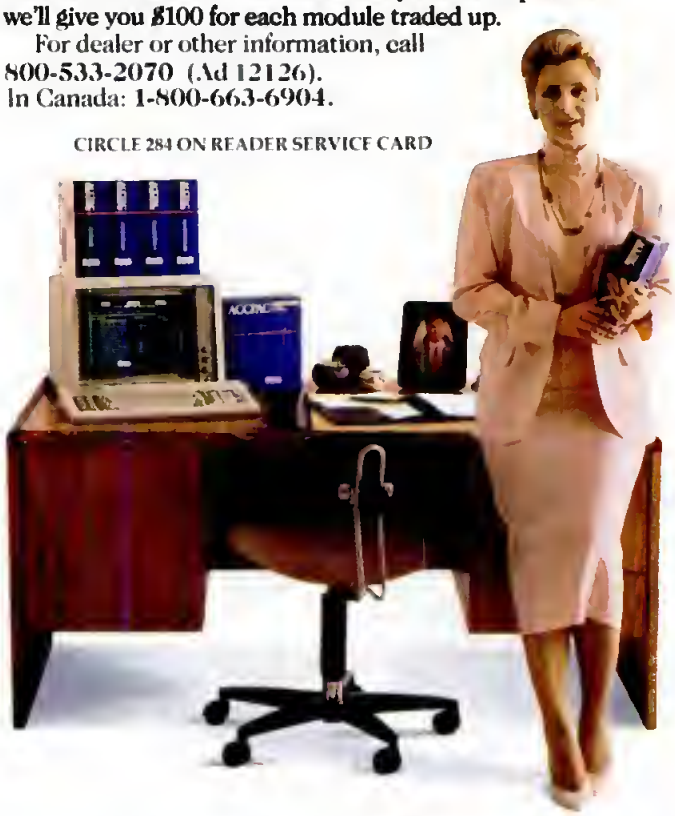
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how to scan correctly, but you will find the minimum information you need to set up and use the unit and printer software.

The BarBoard is generally sold for point-of-sale use and for tracking work-in-process applications, but it is perfectly suitable for any general-purpose PC-based bar code application. At $595, it's well within the price range of its competitors.—**M. David Stone**

TPS ELECTRONICS

TPS PC-300
TPS PC-3000

The TPS PC-300 ($795) and PC-3000 ($995), from TPS Electronics, are part of a large family of bar code readers. The 300 series includes about 50 units, all of which are functionally identical except that each one is designed for a different computer.

The 3000 series is similar to the 300 series, except that each unit includes both a bar code reader and a magnetic stripe reader. Both readers are for the IBM PC or XT and for systems that can exchange keyboards with the PC or XT.

The PC-3000 looks physically identical to the PC-300, too, except that it features a magnetic stripe reader on the top of the unit. According to TPS Electronics, the magnetic stripe reader can read several magnetic stripe standards, including ABA Track 2, ANSI x 4.16, and ISO 3554, with other codes available as options. In an informal test of the stripe reader, we used it to read some credit cards successfully.

The bar code readers in both units are essentially identical—at least in theory. The units can read UPC A and E, Code 39, Interleaved 2 of 5, and Codabar. Normally, you order the units with ROM chips that can read any two of the four choices. You can also change the ROM if your needs change by sending the unit back to the factory.

TPS Electronics normally recommends against having more than two recognition choices in a unit because of possible confusion for the auto-selection feature. Nevertheless, the PC-300 we reviewed read all four kinds of bar codes. The PC-3000 read all but Interleaved 2 of 5. In all of the tests, the units selected the proper code without problems.

In the performance tests, both units dropped the last digit from the UPC A and Codabar samples. They read Code 39 exactly as it appeared on the page, and they expanded UPC E. The PC-300 read the Interleaved 2 of 5 exactly as it appeared on the page.

Notably absent is an easy way to change these and other data interpretation features; many features, however, are available as options when you order a unit. For example, in the units we tested, data sent to the PC did not include start and stop information, but this option is available.

Both units performed acceptably on the performance tests. The PC-300 was one of the few readers that managed to read a notable percentage of the poor-quality dot matrix samples. It also read some of the "tiny" samples. Performance was good in horizontal orientation, vertical orientation, right-to-left reading, and reading in a curved sweep. It was less reliable when reading from a curved surface.

Performance when reading through shiny plastic was good with UPC and Code 39, but marginal with Codabar and Interleaved 2 of 5.

Results with the PC-3000 were similar, but with some important differences. The PC-3000 did not read the poor-quality dot matrix samples as well as the PC-300. It did match the other's good performance in horizontal orientation, vertical orientation, reading from right to left, and reading in a curved sweep. It also matched the PC-300 in reading through shiny plastic, but surprisingly it did far worse than the PC-300 when reading from a curved surface.

The metal wands on the TPS units are about 6½ inches long by ½ inch in diameter. They will read at any angle from perpendicular to about 45 degrees, with a best reading angle of about 15 degrees. This angle is a little steep for holding the wand like a pen, but you can learn to use the wand at this angle with a little practice.

The cord from the PC-300 to the system unit is 5 feet long, giving you more than enough slack to place the unit conveniently. The 6-foot coiled cable to the wand offers even more freedom of movement.

Documentation for the TPS units is sparse: one page of typed, single-spaced text for the PC-300 and two pages for the PC-3000. A TPS Electronics representative pointed out that this is enough to explain how to set up the unit. Unfortunately, it doesn't explain—or even mention—any of the available options.

The documentation doesn't even mention TPS Electronics' own software for printing Code 39 bar codes. (The software supports the Epson FX-80, FX-85, FX-100, and FX-286; the IBM Graphics Printer or the IBM ProPrinter; the Star Micronics Gemini; and the HP LaserJet series.) The company has no software for printing

PC MAGAZINE FACT FILE



TPS Electronics
4047 Transport St.
Palo Alto, CA 94303
(415) 856-6833

TPS PC-300
List Price: $795, including interface box, wand, and cables.
Requires: IBM PC, XT, or compatible (other versions available for the AT, PS/2, and other system models).
In Short: With roughly 50 versions of the series 300 bar code reader, TPS offers a reader for most MS-DOS computers and terminals. Notably absent is any easy way to change the way bar codes are interpreted, though factory-supplied options are available.
CIRCLE **678** ON READER SERVICE CARD

TPS PC-3000
List Price: $995, including interface box with wand, magnetic read head, and cabling.
Requires: IBM PC, XT, or compatible (other versions available for the AT, PS/2, and other system models).
In Short: Essentially identical to the PC-300 from TPS, the PC-3000 adds a magnetic stripe reader to the bar code reading capability. As with the PC-300, there is no easy way to change the way bar codes are interpreted; factory-supplied options are available
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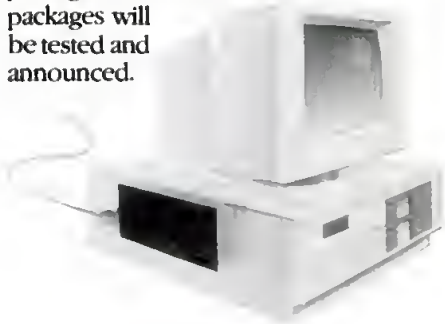


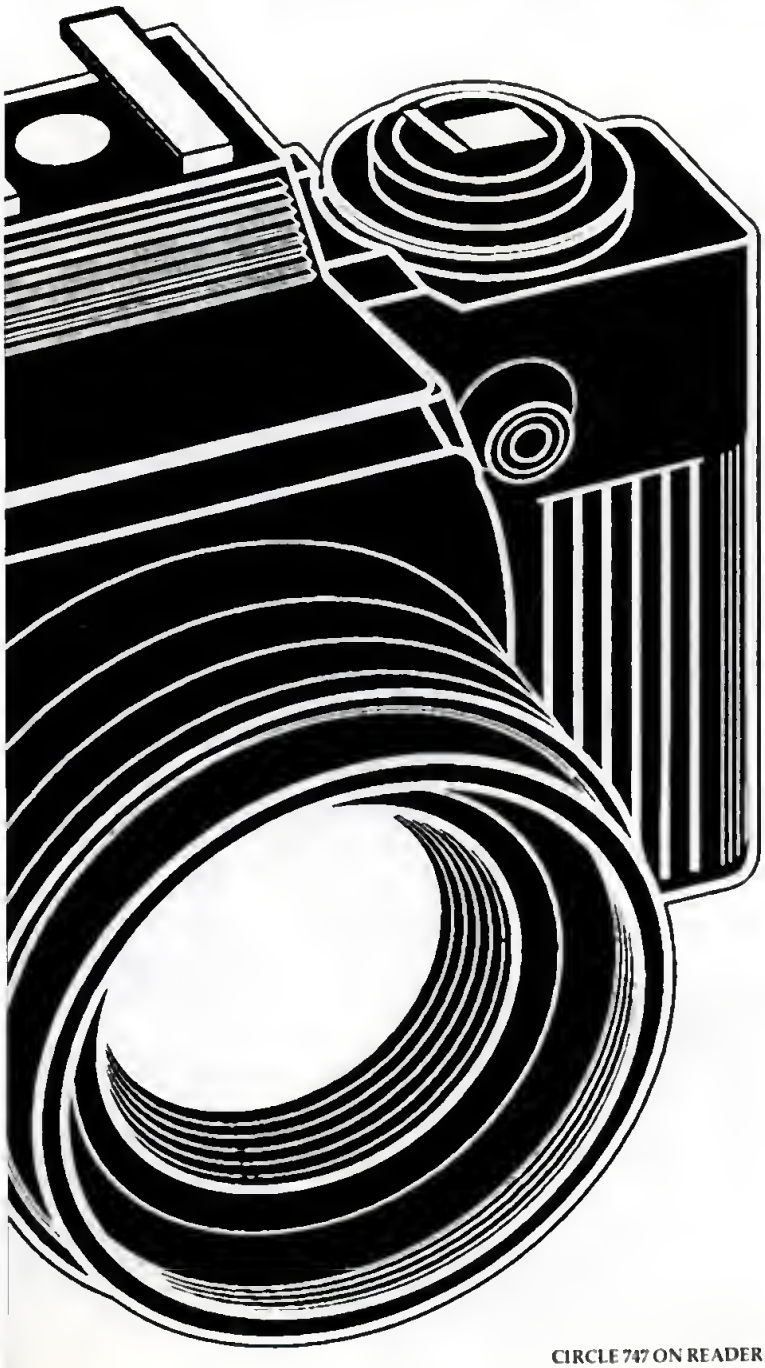
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CIRCLE 747 ON READER SERVICE CARD

other bar codes, and no particular favorites to recommend. TPS Electronics says it will recommend different packages to users, according to their applications.

TPS Electronics sells optional scanning hardware to replace the standard wand for both series 300 and series 3000 units. These include bar code slot readers, noncontact wands, and stationary readers that will let you pass an object underneath the reader (as with a book). An interface for a laser gun is also available.

The price of the readers can range from $100 less than the list price shown here to $300 more, depending on the options.

The PC-300 and PC-3000 packages are clearly designed for those who are aware of all the variations in bar code readers and know enough to order a unit that's configured to fit their needs. If you are in that category, these units are certainly worth a look. If not, be careful to confirm—before you buy—that the reader will work in your application.—**M. David Stone**

PC MAGAZINE EDITOR'S CHOICE

- **Aedex BCD-200**
- **Scanstar PC Bar Code Reader**

Able to automatically discriminate among a variety of bar code types, the Aedex BCD-200 works with both wands and laser guns to deliver sound, consistent performance in high-volume applications. The unit is programmable, with bar code menus that are scanned to set configuration parameters; settings are stored in nonvolatile RAM. Keyboard input and editing is also possible, though not simultaneously with scanning.

When used with the laser gun, the decoder sets a standard for other units through its speed and accuracy in recognizing even dot-matrix-printed codes.

Comparable to the BCD-200 is Computer Identics' Scanstar PC Bar Code Reader, a programmable wedge-style reader that offers auto-discrimination among 14 code types, an auxiliary serial port (for reading input from portable readers and other devices), and parameters set by scanning codes in the manual. This all-around reading device works with wands, laser guns, and slot readers for exceptional reads of all but extremely dense codes at a wide range of angles.

VIDEX INC.

TimeWand

The TimeWand is one of the smallest portable bar code readers available. About the size of a credit card, though about 10 times thicker, the TimeWand weighs less than two ounces and has a tiny bulbous optical scanner at one corner.

The TimeWand comes in three memory sizes: 2K, 8K, and 16K. The recharger that comes with the unit doubles as the downloading station to the personal computer.

Before you can use the reader, you must charge it for 10 to 14 hours. It slips into the top end of the recharger to about one-third of its length; this is the same position it takes when downloading data to the PC. The recharger is itself relatively small, measuring about 3 by 4 by 1¼ inches. It connects to a PC's serial port and to a transformer that plugs into a wall outlet.

Two LED indicator lights on the recharger light up as data is received from the wand and transmitted to the PC. The transmit light can also be used to test the recharger. Once the wand is charged, it will retain that charge for as long as 3 days.

You use the TimeWand to scan a bar code in much the same way as you would a pen wand. You draw the read head across the bars in a fairly straight line and at a quick, steady pace. For the best results, you must hold it at a 45-degree angle so that the read head is perpendicular to the surface of the bar code.

As you scan, you must press a scan button on the front face of the reader; the best approach is to hold it between your thumb and forefinger with your thumb pressing the button. While it feels awkward at first, you quickly get used to it.

Because of the TimeWand's portability—and thus limited memory—it will not automatically discriminate among a range of bar codes. To read different bar code types, you have to load one of 21 different read programs through an initialization process run from the menu-driven software.

Eighteen of these programs allow you to read variations on Code 39, which the company says is the code most used and requested by customers. Some of those programs allow the TimeWand to discriminate between Code 39 and one other code, such as UPC A and E or Interleaved 2 of 5.

The TimeWand will also read Codabar and EAN and can read hierarchies of code (sets of code) in a predetermined pattern. With the 16K wand you can store about 1,800 to 1,900 scans, depending on the size of the read program loaded.

When the bar code is successfully scanned, the reader beeps and a tiny indicator light on the top edge flashes. In read tests, the TimeWand had no trouble read-

PC MAGAZINE FACT FILE



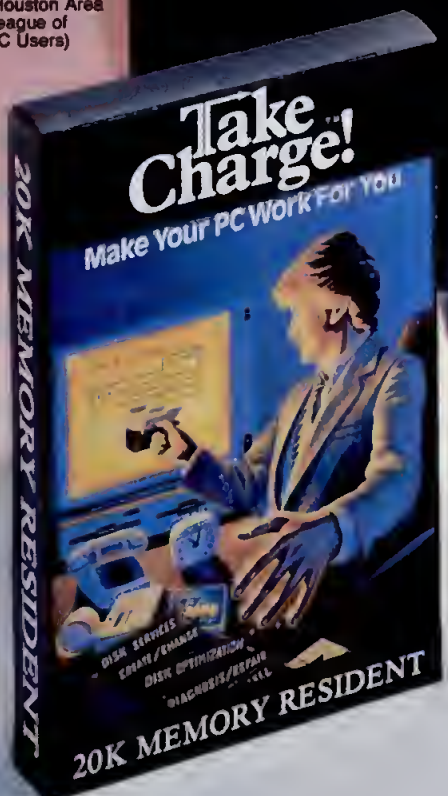
TimeWand
Videx Inc.
1105 NE Circle Blvd.
Corvallis, OR 97330
(503) 758-0521
List Price: 2K version, $646; 8K version, $676; 16K version, $696; all versions include the TimeWand, Recharger Downloading Station, cabling, and IBM Communications Software.
Requires: 512K RAM, IBM PC or compatible, two disk drives or hard disk, serial port.
In Short: The TimeWand is perhaps the smallest portable bar code reader available. When fully charged it can retain up to 16K of bar code programs and data for about 3 days. The data from the wand is downloaded to a PC in an ASCII file format that can be edited for import into other programs.
CIRCLE 676 ON READER SERVICE CARD

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CIRCLE 283 ON READER SERVICE CARD

System Requirements: IBM™ PC, XT, AT, PS/2, or 100% IBM compatible. Requires hard disk. MS/DOS 2.0 or greater. 320 K minimum. Network compatible. All product names are trademarks of their manufacturers. Copyright 1988 Departmental Technologies, Inc. All rights reserved

ing any of the 21 available codes. The angle of the reader had little bearing on the success of the read as long as the protruding plastic bulb of the head was swept across all the bars. Speed, however, was a major factor. The first-pass read scores deteriorated when the scan speed was slowed down. Actually, the faster the better, it seems—the speed used to strike a match was the best.

The TimeWand read well through plastic wrapping and on curved surfaces. To read in both directions, you must load a bidirectional read program, which was offered only for Code 39 and Interleaved 2 of 5. Because of the limited memory capacity of the wand, the UPC E bar codes could not be read bidirectionally because they are decoded in their fully expanded form—that is, with four added zeros in the middle of the number.

A Videx spokesman said the company also offers custom programs, which cost anywhere between $400 and $2,000. He said it would be fairly easy to write a bidirectional program for any of the codes, or a program that automatically discriminates among different codes, but the memory consumption of such a program would severely limit the data capacity.

Bar code scans are accumulated in an ASCII file that is then transferred to a PC; you can review the file on screen, print it, or transfer it to another program. In its standard format, the scanned information has a column for the number of the scan, the date, the time, the source (from a bar code scan or keypad), and the decoded bar code. This format can be changed by using a word processing program or the EDLIN commands in DOS.

The TimeWand has a 90-day warranty. After that, virtually any repair will cost only about $25, says a company spokesman. The epoxy plastic read head is replaceable by the user and costs $15. Videx's dedicated customer service department can solve some problems on the telephone. Because the TimeWand is so compact and light—it fits comfortably into a shirt pocket—it is an excellent reader for any remote inventory or warehousing application. But you can also use it for special applications, such as security rounds, document control, and even library loans.—**Henry Fersko-Weiss**

WELCH ALLYN INC.

Welch Allyn HBD-100 Bar Code Board Welch Allyn HBD-PC Bar Code Data Entry Interface

Welch Allyn makes a number of bar code products, among them the $558 HBD-100 Bar Code Board and the $458 HBD-PC

Ideal Working Condition



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Bar Code Data Entry Interface.

The HBD-100 Bar Code Board has several things in its favor. It can read and decode six major bar code formats, for example, and it offers a firmware/software option that lets you print bar codes or connect external serial devices such as weight scales or magnetic-stripe readers. Unfortunately, this product and its close relative, the HBD-PC Bar Code Data Entry Interface, don't get along well with some IBM PC compatibles and software.

Though the HBD-100 and HBD-PC are quite similar, there are a few differences. On the one hand, the option of printing bar codes and communicating with external serial devices is available only with the HBD-100, not with its less sophisticated cousin. On the other hand, the HBD-100 reads a more limited range of bar codes: Code 39, Standard and Interleaved 2 of 5, UPC A and E, EAN/JAN, Codabar, and Code 128. The HBD-PC reads the same codes (except Codabar) and also handles Code 93, MSI, Code 11, and UPC D (a new code, not yet in use).

■ The HBD-100 and the HBD-PC scanned bar codes very capably in varying conditions. But make sure they'll work with your system before you buy.

A nice feature of the Welch Allyn wand is its replaceable tip. Though the wand will last for hundreds of thousands of scans, if you accidentally damage the tip, you can easily replace it for only $6.

Once installed, the reader transmits data into your computer program as if you had entered it through the keyboard. The HBD-100, however, couldn't transmit into the *Windows Write* or *Leading Edge Word Processing* programs in our tests. The manufacturer didn't know if other software would pose similar problems.

The HBD-PC was even more particular—on the hardware side. It would not work with one IBM XT compatible (the ITT Xtra XP) used for testing the HBD-100 and several other bar code readers. The manufacturer also acknowledged problems with some Leading Edge models, with the Zenith 248, and with certain Sperry computers. Some of these problems apparently have been corrected; others are being worked on.

The HBD-100 proved quite capable at

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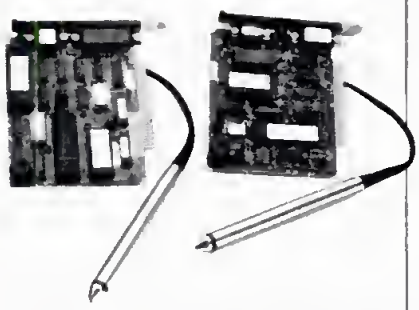
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■ BAR CODE READERS

reading bar codes; we even scanned high-density codes using the system's high-density wand. The reader decoded all our samples on the first pass without difficulty. It also read the Codabar samples created on a dot matrix printer with a weak ribbon, but it didn't read dot matrix samples in the UPC A and Code 39 formats. (Some bar code readers, however, cannot read any of

PC MAGAZINE FACT FILE



Welch Allyn Inc.
Industrial Products Division
Jordan Rd.
Skaneateles Falls, NY 13153-0187
(315) 685-4390

Welch Allyn HBD-100 Bar Code Board
List Price: $558 for half-card, cables, sample software, and *Comm-Pak*, *Print-Pak*, and *Scan-Pak* firmware; URS Ultra Resolution Scanner, $197.
Requires: IBM PC, XT, AT, or 100 percent compatible computer, or PS/2 system.
In Short: The HBD-100 can read a range of standard bar codes with alacrity. It can come with a wand, gun, or swipe scanner and is easy to install. The one drawback is its inability to work with some software and some imperfectly compatible IBM PC compatibles.

CIRCLE **675** ON READER SERVICE CARD

Welch Allyn HBD-PC Bar Code Data Entry Interface
List Price: $458 for half-card and cables; URS Ultra Resolution Scanner, $197.
Requires: IBM PC, XT, AT, or 100 percent compatible computer, or PS/2 system.
In Short: The HBD-PC easily reads a range of standard bar codes. It can come with a wand, gun, or swipe scanner and is easy to install. The one drawback is its inability to work with some software and some imperfectly compatible IBM PC compatibles.

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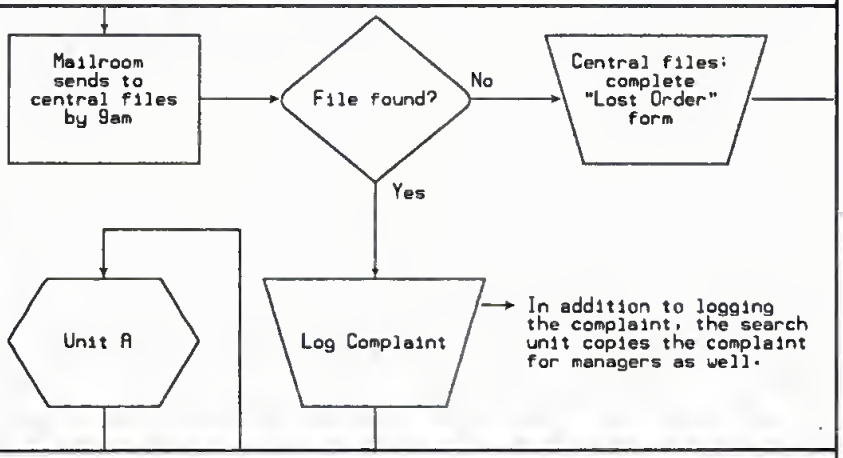
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* March 10, 1987 issue, page 278

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The chart fragment above was produced on an HP LaserJet-Plus and is actual size and unretouched. Publication quality charts like this can be produced using only minutes of preparation time and seconds of print time.

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the dot matrix samples.)

The HBD-100 read the bar codes under most conditions likely to occur with everyday usage, including varying speeds and angles. But the success rate dropped considerably when I held the wand exactly perpendicular to the codes. The direction of the reading motion made no difference, and curved bar codes didn't present any difficulty.

In reading UPC E codes, the HBD-100 included the four zeros in the middle that many other readers omit. This spec is acceptable for the code, but the software doesn't let you opt for the other form. Also, the HBD-100 deleted the check digit on UPC A codes; this, too, was not selectable.

Generally, both the HBD-100 and the HBD-PC scanned bar codes very capably, without errors and in varying conditions. But make sure they'll work with your system before you buy. Their quirky responses to some hardware and software are definitely factors to consider.

—Henry Fersko-Weiss

WORTHINGTON DATA SOLUTIONS

WDP Combo Reader

The WDP Combo Reader, from Worthington Data Solutions, derives its name from the fact that you can either install it internally or mount it to the outside of your monitor or desk like a radar device on the dashboard of your car. The $385 unit reads standard bar code formats without requiring you to tell it which one you are scanning, and it operates under most conditions. (The unit is also available for PS/2 models for $399.)

The case of the WDP Reader is made of high-impact plastic, so you can pry it open without fear of breaking the case. This is important because to install the reader you first have to check the settings on three banks of DIP switches inside. The DIP switches allow you to enable or disable the bar code formats; they are set at the factory, but you can change them. Once you've made your choices, the reader will automatically discriminate among the types enabled. Other switch settings control the terminator character sent—such as carriage return, horizontal tab, or none—the start and end characters, the transmission interval between characters, and type of computer. The documentation provides a good guide to the various DIP switch settings.

If you have an available expansion slot, internal installation puts the board completely out of your way. Still, you can always reclaim the slot later if you need to by screwing the board back into the box and mounting it externally. A "Y" cable connects the reader to the computer via the keyboard cable and the keyboard port.

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CIRCLE 356 ON READER SERVICE CARD

You have your choice of a low-, medium-, or high-resolution stainless-steel wand. For this review we were sent an Opticon wand, which has a durable tip of synthetic glass and retracts on a spring if pushed down hard, so the tip is well protected. We also received a wand made by Welch Allyn; it has a replaceable ($5) tip of stainless steel with a slightly recessed end that houses a glass window. Both wands fit into your hand like one of those large ballpoint pens that have half a dozen different colored points, and you use the wand as you would a pen.

Holding the wand at an angle of 30 degrees to the bar code produces the best reading results. Nevertheless, the WDP reads well when the angle is anywhere from 0 to about 70 degrees. The wand can handle speeds of 3 to 30 inches per second, encountering problems only at faster or slower speeds.

Scanning in a straight line across the code produces the best first-pass results, but even if you move across the code in an arc the WDP still reads, as long as you pass over all the lines. The wand can read bar codes on a curved surface, but it helps if the object and the wand are moved simultaneously in opposite directions or if the wand stays still. Thin cellophane packaging and even dirty bar codes were read with only a slight drop in the percentage of successful first-pass reads.

In tests of the different bar code for-

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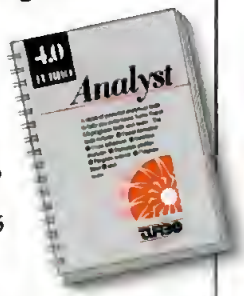
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CIRCLE 389 ON READER SERVICE CARD

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WDP Combo Reader
Worthington Data Solutions
417-A Ingalls St.
Santa Cruz, CA 95060
(408) 458-9938
List Price: $385 for decoder box; medium-, low-, or high-resolution stainless steel wand; wand holder; cable; and card mounting bracket; unit for PS/2 models, $399; cable upgrade from PC to PS/2 models, $30.
Requires: IBM PC, XT, AT, or compatible keyboard and BIOS.
In Short: The WDP Combo Reader is a wand reader with the unique ability to be installed externally or internally. It has a high degree of reading accuracy and lets you adjust transmission formats with DIP switches

CIRCLE 673 ON READER SERVICE CARD

Software Breakthrough: the RANDOM information processor

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■ Information Windows

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Tornado is FREE-FORM. It works the way you think. To start a new window you just press N, and enter information. No file names. No extra keystrokes. To retrieve information you just press G (for Get), with any word or phrase—you'll watch Tornado zip through your windows like lightning linking and opening those requested. You can even flip through your windows with the arrow keys and watch them instantly pile up and lift away. These are just three of 18 easy but powerful features.

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mats, the WDP had a much better first-pass success percentage with UPC A and E and Code 39 than with Interleaved 2 of 5. The reader was unable to handle dot matrix bar codes produced with a medium-quality ribbon. The medium-density wand that usually comes with the reader could not read high-density bar codes with lines that were .0067 inch wide or narrower. However, you can get a high-density wand instead, at no extra charge, that will read lines as thin as .004 inch and codes with up to 32 characters. The cable for the wand is coiled, so it will stretch from 4 feet to about 12½ feet.

■ Overall, the WDP Combo Reader is easy to use and offers the unique advantage of external or internal installation. It is a solid and accurate performer.

The bar codes can be read into virtually any software, from a word processor to a spreadsheet or database program. You can enter quantities on your own, if the accumulate mode is enabled, by scanning a "barpad" of numbers; the number accumulates until an enter bar code is read. You can also enter any other ASCII characters by scanning bar codes, including those that emulate function keys.

No software is necessary to read bar codes, but Worthington Data Solutions does offer several general-purpose printing packages. The WDP Reader has a 1-year warranty on all parts. After the first year, you can buy a maintenance contract for $25 a year. Customer support is quick and friendly.

Overall, the WDP Combo Reader is easy to use and offers the unique advantage of external or internal installation. It is a solid and accurate performer.

—Henry Fersko-Weiss

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Your 80386-based PC should run two to three times as fast as your old AT. This speed-up is primarily due to the doubling of the clock speed from 8 to 16 MHz. The new MicroWay products discussed below take advantage of the real power of your 80386, which is actually 4 to 16 times that of the old AT! These new products take advantage of the 32 bit registers and data bus of the 80386 and the Weitek 1167 numeric coprocessor chip set. They include a family of MicroWay 80386 compilers that run in protected mode and numeric coprocessor cards that utilize the Weitek technology.

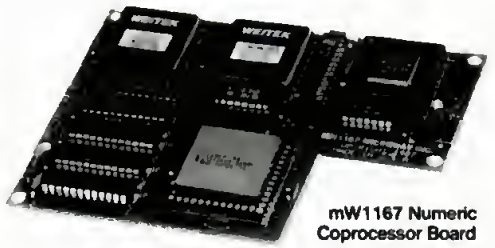
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mW1167 Numeric Coprocessor Board

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MicroWay 80386 Compilers

NDP Fortran-386 and **NDP C-386** are globally optimizing 80386 native code compilers that support a number of Numeric Data Processors, including the 80287, 80387 and mW1167. They generate mainframe quality optimized code and are syntactically and operationally compatible to the Berkeley 4.2 Unix f77 and PCC compilers. MS-DOS specific extensions have been added where necessary to make it easy to port programs written with Microsoft C or Fortran and R/M Fortran.

The compilers are presently available in two formats: Microport Unix 5.3 or MS-DOS as extended by the Phar Lap Tools. MicroWay will port them to other 80386 operating systems such as OS/2 as the need arises and as 80386 versions become available.

The key to addressing more than 640 kbytes is the use of 32-bit integers to address arrays. NDP Fortran-386 generates 32-bit code which executes 3 to 8 times faster than the current generation of 16-bit compilers. There are three elements each of which contributes a factor of 2 to this speed increase: very efficient use of 80386 registers to store 32-bit entities, the use of inline 32-bit arithmetic instead of library calls, and a doubling in the effective utilization of the system data bus.

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CIRCLE 331 ON READER SERVICE CARD

■ UTILITIES ■ ROBERT L. MORTON

PUTTING AN END TO HOTKEY HASSLES

When your memory-resident utilities or your macros conflict with the keystrokes you need for your applications, you've got a problem. With ALLKEYS you've got the answer.

Pop-up utilities, which put everything from calculators to file managers at the touch of a key, have become an essential part of using the PC efficiently. If you share my addiction to pop-ups, however, you've probably also experienced my nightmare. While trying to insert a line of text with your word processor, you suddenly find you've brought up an on-screen notepad instead. With only a limited number of key combinations available, the hotkeys used by your memory-resident utilities often coincide with the keystrokes needed by your regular applications.

The more often you've edited your AUTOEXEC.BAT file to exclude or include your pop-ups, the more you'll appreciate ALLKEYS. ALLKEYS.COM is a TSR (Terminate-and-Stay-Resident) program that lets you instantly disable or enable the hotkeys used by your other memory-resident programs. When you want them, your TSR utilities are there, loaded as usual. When their operation would interfere with your application, you simply toggle them off, leaving them dormant. Toggle ALLKEYS again and your hotkeys become hot again, restoring your pop-ups to life.

ALLKEYS can be especially useful if you use RAM-resident keyboard macro programs such as *SuperKey*. If you find that the keys to which you're assigning your macros sometimes conflict with your applications, simply use ALLKEYS to toggle them off and on again. In addition, when you run out of infrequently used keys for macros, you can even make use of normal, A–Z keys, using ALLKEYS to toggle them between their regular and macro use.

The easiest way to obtain a copy of ALLKEYS.COM is to download it via modem from PC MagNet. (See the accompanying sidebar "ALLKEYS by Modem.") The assembly language source code, ALLKEYS.ASM, is printed here, as is ALLKEYS.BAS, a BASIC program that will automatically create ALLKEYS.COM. The .ASM and .BAS files for ALLKEYS are also available without charge from PC MagNet.

To use ALLKEYS, you must load it both before and after the group of pop-ups whose hotkeys you want to control. While you can do this from the DOS prompt, the easiest way to use ALLKEYS is to include its two entries in your AUTOEXEC.BAT file, thus:

```
[d:][path]ALLKEYS
POP-UP #1
POP-UP #2
POP-UP #3
...
[d:][path]ALLKEYS
```

To toggle ALLKEYS' action, just press Ctrl-Alt-Z at any time. ALLKEYS confirms its new on/off status by sending a short sequence of beeps through the speaker. ALLKEYS is on (and the controlled TSRs are off) if the beeps increase in pitch; if the beeps get lower, the reverse state is in effect. When initially loaded, ALLKEYS defaults to off, which means that your pop-ups operate normally.

Those RAM-resident utilities that you *don't* want toggled off and on should be placed outside ALLKEYS' boundaries. These might include a keyboard enhancement utility such as QUICKEYS (Programming/Utilities, *PC Magazine*, March 11, 1986), which speeds up your keyboard's typematic action.

At any time after its initial loading, you

PRODUCTIVITY INDEX

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ALLKEYS shares your keyboard with key-stealing TSR programs.
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Mixing network operating systems; connecting laptops to LANs.

can uninstall ALLKEYS by entering

```
ALLKEYS /U
```

This is useful if you want to load another copy of ALLKEYS to use with a different set of pop-ups. When entered with the /U parameter, ALLKEYS attempts to uninstall and remove itself completely from memory. If successful, the message "ALLKEYS uninstalled" is displayed. However, if additional pop-ups were loaded after ALLKEYS was installed (or you use *SideKick*), ALLKEYS will only disable itself. This has the same practical effect as complete uninstallation, though ALLKEYS still remains in memory (it occupies just over 800 bytes of RAM). When this happens, the message "Vectors could not be restored—ALLKEYS disabled" will be displayed.

INSIDE ALLKEYS When a .COM format program is loaded, DOS assigns all available memory to it. Normally, the program will perform its function and then exit back to DOS, releasing all its allocated memory for use by the next program. Pop-ups, on the other hand, need to remain in some of this memory so that they *won't* be overwritten by the next program. DOS provides a TSR function that allows programs to do this.

When a program uses this function, it must specify how much memory should be permanently removed from the memory pool. DOS thereafter considers that reserved memory as an extension of itself, so it will not be overlaid when other programs are subsequently loaded. A dormant program that just sat in memory, though, would only waste RAM. Pop-ups must thus incorporate some mechanism—a trigger key—that will pop them up.

Every time a key is pressed or released, the keyboard generates an interrupt 9, which instructs the CPU (Central Processing Unit) to call a routine whose address is stored in a table in low memory. Normally, this address points to the BIOS (Basic Input/Output System) keyboard handler. This is a routine in ROM (Read-Only Memory) that translates the scan code sent from the keyboard into ASCII and then deposits it in the keyboard buffer.

To check for their hotkeys, most pop-ups save the current interrupt 9 address (vector) and substitute the address of their new keyboard handler. This is usually done either directly or by using DOS interrupt 21h functions 25h (Set Interrupt Vector) and 35h (Get Interrupt Vector). Then,

```
;=============================================================================
; Allkeys- Returns popup stolen key combinations back to the applications.
;          Load "ALLKEYS" before and after your pop-ups.
;          Then press Ctrl-Alt-S to toggle ALLKEYS on/off.
;          "beep..BEEP" signals All keys on. "BEEP..beep" signals all keys off.
;=============================================================================
CSEG        SEGMENT   PARA PUBLIC 'CODE'
            ASSUME    CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG
            ORG       100H

FIRST:      JMP       INIT

COPYRIGHT   DB   "ALLKEYS 1.0 (c) 1988 Biff Communications Co.",13,10
            DB   "PC Magazine ",254," Robert L. Morton",13,10
            DB   "Low copy installed",13,10,"$"

MESG1       DB   "ALLKEYS high copy installed",13,10
            DB   "Ctrl-Alt-S to toggle tsr's on/off",13,10,"$"

MESG2       DB   "ALLKEYS already installed high and low",13,10,"$"

MESG2       DB   "Vectors could not be restored - ALLKEYS disabled",13,10,"$"

MESG4       DB   "ALLKEYS not loaded yet",13,10,"$"

MESG5       DB   "ALLKEYS un-installed",13,10,"$"

ORIG_INT9   DW   0,0                ;The original int 9 vector
ORIG_INT16  DW   0,0                ;The original int 16h vector

USED_INT9   DB   0,0                ;The used int 9 vector
USED_INT16  DB   0,0                ;The used int 16h vector

HOTKEY      DB   44                 ;Our HOT key: "S"
SHIFT_MASK  DB   0CH                ;Our shift mask: "Ctrl-Alt"

ALLKEYS     DB   0                  ;Allkeys on/off status flag.

DISABLE     DB   0                  ;If not to 1, Allkeys will not respond
                                    ;  to Ctrl-Alt-S combination and all
                                    ;  keystrokes will be processed normally.

TONE_LOW    DW   500                ;Low boundary "beep"
TONE_HIGH   DW   1500               ;High boundary "BEEP"
TONE_STEP   DW   500                ;Step between tones
TONE_LENGTH DW   50                 ;Length of each tone
;-----------------------------------------------------------------------------
; New interrupt 9 handling routine.
;-----------------------------------------------------------------------------
NEW_INT9    PROC      NEAR
            ASSUME    CS:CSEG, DS:NOTHING, ES:NOTHING, SS:NOTHING

            STI                                 ;Enable interrupts
            PUSH      AX                        ;Save AX

            CMP       CS:DISABLE,0              ;Are we disabled?
            JNE       KB1                       ;Jump out if so.

            IN        AL,60H                    ;Get key just pressed
            CMP       AL,CS:HOTKEY              ;Was it our HOT key?
            JNE       KB2                       ;If not, jump KB2

            MOV       AH,2                      ;Get shift states.
            INT       16H
            AND       AL,0FH                    ;Mask out shift keys
            CMP       AL,CS:SHIFT_MASK          ;Was it our shift mask?
            JNE       KB2                       ;If not, jump KB2
            CALL      KB_RESET                  ;Reset keyboard

            XOR       CS:ALLKEYS,0FFH           ;Toggle request flag
            CALL      BEEP_STATUS               ;Beep Allkeys' status

KB1:        POP       AX                        ;Restore AX
            JMP       DWORD PTR CS:USED_INT9    ;Exit through popup chain

KB2:        CMP       CS:ALLKEYS,0              ;Allkeys' request flag set?
            JE        KB1                       ;If not, jump KB1
            POP       AX                        ;Restore AX
            JMP       DWORD PTR CS:ORIG_INT9    ;Skip popup chain and exit
                                                ;  directly to original.
NEW_INT9    ENDP

;-----------------------------------------------------------------------------
; New interrupt 16h handling routine.
;-----------------------------------------------------------------------------
NEW_INT16   PROC      NEAR
            ASSUME    CS:CSEG, DS:NOTHING, ES:NOTHING, SS:NOTHING

            STI                                 ;Enable interrupts
            CMP       CS:DISABLE,0              ;Are we disabled?
            JNE       INT16_OUT                 ;Jump out if so.

            CMP       CS:ALLKEYS,0              ;Allkeys' request flag set?
            JE        INT16_OUT                 ;NO - Leave through used 16h
            JMP       DWORD PTR CS:ORIG_INT16   ;Yes- Leave through original
INT16_OUT:  JMP       DWORD PTR CS:USED_INT16

NEW_INT16   ENDP

;-----------------------------------------------------------------------------
;  Routine to beep Allkeys' status through the speaker.
;  If Allkeys is on, "beep..BEEP". If Allkeys is off, "BEEP..beep".
;-----------------------------------------------------------------------------
BEEP_STATUS PROC      NEAR
            ASSUME    CS:CSEG, DS:NOTHING, ES:NOTHING, SS:NOTHING

            PUSH      CX                        ;Save needed registers
            PUSH      DS

            PUSH      CS                        ;Point DS to our data
            POP       DS
            ASSUME    DS:CSEG

            CMP       ALLKEYS,0                 ;Allkeys off?
            JE        BS2                       ;If so, jump BS2

;Allkeys on - Ascend from a LOW tone to a HIGH tone.

            MOV       CX,TONE_LOW               ;Start at the bottom
BS1:        CALL      SOUND                     ;Make the sound
            ADD       CX,TONE_STEP              ;Add the next step
            CMP       CX,TONE_HIGH              ;Are we over the top?
            JNA       BS1                       ;NO - then keep on going
            JMP       BS_OUT                    ;Yes- then jump out

;Allkeys off- Descend from a HIGH tone to a LOW tone.

BS2:        MOV       CX,TONE_HIGH              ;Start at the top
BS2:        CALL      SOUND                     ;Make the sound
            SUB       CX,TONE_STEP              ;Subtract the next step
            CMP       CX,TONE_LOW               ;Are we below the bottom?
            JNB       BS3                       ;NO, then keep on going

BS_OUT:     POP       DS                        ;Restore used registers
            POP       CX
            RET

BEEP_STATUS ENDP
```

(ALLKEYS.ASM continues)

ALLKEYS.ASM: *The assembly language source code for ALLKEYS.COM.*

when an interrupt 9 is generated, the pop-up can check to see if its designated hotkey has been pressed before it passes the keystroke on to the BIOS. If more than one pop-up has been loaded, the last loaded is the first to check for its hotkey. If the key pressed was not its own trigger key, the pop-up then transfers control to the one loaded before it. The checking process is then repeated until finally the BIOS gets the keystroke.

To pick up their keystrokes, applications normally call BIOS interrupt 16h. (Some applications, like DOS's EDLIN program, use DOS interrupt 21h instead, but ultimately interrupt 16h is invoked in any case.) Interrupt 16h provides three functions to the applications: function 0 (Read Next Keyboard Character), function 1 (Report Whether Character Ready), and function 2 (Get Shift Status). By intercepting interrupt 16h, pop-ups gain an alternative mechanism for telling when their hotkeys are pressed. When an application calls this interrupt requesting a key, the pop-up can make its own check first.

In terms of toggling itself on and off, ALLKEYS does much the same thing as other pop-ups. Its main objective, however, is to sneak keystrokes past the whole pop-up chain. To do this, ALLKEYS needs the original interrupt 9 and 16h vectors—the ones in effect before the pop-ups were loaded. Then, when a key is pressed (interrupt 9) or requested (interrupt 16h), ALLKEYS can simply jump to the original interrupt routine, thus skipping all the pop-ups in between. An example may help you picture exactly how this works.

Suppose that each time you boot up you load a pop-up calendar and a pop-up notepad. Let's assume further that the calendar checks keystrokes using the interrupt 9 method and that the notepad checks keystrokes using the interrupt 16h method. Before these two pop-ups were loaded, the path of a keystroke went from keyboard to BIOS to application. Now, however, a keystroke will travel from the keyboard to the calendar to the BIOS to the notepad and then to the application, as illustrated in the "before" part of the diagram "How ALLKEYS Functions." If, while on its journey to the application, a keystroke is recognized as its hotkey by either the calendar or the notepad, the keystroke's trip will end prematurely.

Now let's suppose you have loaded ALLKEYS before and after you loaded your calendar and notepad. When ALL-

```
;-----------------------------------------------------------------------
; Routine to produce a sound through the speaker.
; CX contains the frequency. Variable TONE_LENGTH contains the length.
;-----------------------------------------------------------------------
SOUND           PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:NOTHING, SS:NOTHING

                PUSH    AX                      ;Save needed registers
                PUSH    CX
                PUSH    DX

;Convert the frequency.

                MOV     DX,12h                  ;Upper part
                MOV     AX,34DEh                ;Lower part
                DIV     CX                      ;Divide by frequency
                MOV     CX,AX                   ;to get quotient.

;Set the tone.

                MOV     AL,CL                   ;Send low byte
                OUT     42h,AL                  ;out to the timer.
                MOV     AL,CH                   ;Send high byte
                OUT     42h,AL                  ;out to the timer.

;Turn the tone  on.

                IN      AL,61h                  ;Get contents of system port B
                OR      AL,3                    ;Turn speaker and timer on
                OUT     61h,AL                  ;Send out new values to port B

;Delay

                MOV     CX,TONE_LENGTH          ;Put delay count in CX
                CALL    DELAY                   ;Delay

;Turn the tone  off.

                IN      AL,61h                  ;Get port B again
                AND     AL,0FCh                 ;Turn off timer and speaker
                OUT     61h,AL
                POP     DX                      ;Restore used registers
                POP     CX
                POP     AX
                RET

SOUND           ENDP

;-----------------------------------------------------------------------
; Routine to delay. CX contains the factor.
;-----------------------------------------------------------------------
DELAY           PROC    NEAR

                PUSH    CX                      ;Save outside CX
                MOV     CX,0FFH                 ;Move timing constant in CX
DELAY1:         LOOP    DELAY1                  ;Loop for inside
                POP     CX                      ;Restore outside CX
                LOOP    DELAY                   ;Loop for outside
                RET

DELAY           ENDP

;-----------------------------------------------------------------------
; Routine to reset keyboard and 8259 interrupt controller.
;-----------------------------------------------------------------------
KB_RESET        PROC    NEAR

                IN      AL,61H                  ;Get control port value
                MOV     AH,AL                   ;Save in AH
                OR      AL,80H                  ;Set bit 7
                OUT     61H,AL                  ;Output reset value
                MOV     AL,AH                   ;Send original value...
                JMP     SHORT $+2               ;Take your time
                OUT     61H,AL                  ;...to enable keyboard
                CLI                             ;No interrupts now
                MOV     AL,20H                  ;Send end of interrupt
                OUT     20H,AL                  ;value to 8259.
                STI                             ;Re-enable interrupts
                RET

KB_RESET        ENDP

;-----------------------------------------------------------------------
; Initialization for Allkeys....
;-----------------------------------------------------------------------
INIT            PROC    NEAR
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG

;Check if the "/U" parameter was entered on the command line.

                MOV     SI,80h                  ;Point to parm line
                CMP     BYTE PTR [SI],0         ;Any chars entered?
                JNE     INIT1                   ;Yes-jump init1
                JMP     INIT8                   ;No -jump init8

INIT1:          MOV     CL,[SI]                 ;Put parm length in CL
                XOR     CH,CH                   ;Make 16 bit
                INC     SI                      ;Point to next byte
                CLD                             ;Forward

INIT3:          LODSB                           ;Load a byte into AL
                CMP     AL,"/"                  ;Is it our switch?
                JE      INIT3                   ;Jump if so
                LOOP    INIT2                   ;Keep on looking
                JMP     INIT8                   ;No switch found. Jump init8.

INIT2:          AND     BYTE PTR [SI],0DFh      ;Change char to uppercase
                CMP     BYTE PTR [SI],"U"       ;Is it a "U"?
                JE      INIT4                   ;Yes-jump init4
                JMP     INIT4                   ;No -jump init4

;"/U" parameter found. Make sure we're loaded.

INIT4:          CALL    SEC_COPY                ;Check for a second copy.
                JC      INIT5                   ;Jump if found.

                MOV     DX,OFFSET MESG4         ;Print error message
ERR_EXIT:       MOV     AH,9
                INT     21H

                MOV     AX,4C01h                ;Terminate with errorlevel 1
                INT     21H

;Modify resident copy to avoid future searches.

INIT5:          ASSUME  DS:CSEG, ES:NOTHING

                PUSH    ES                      ;Point DS at the resident
                POP     DS                      ;  copy of Allkeys.
                XOR     AX,AX                   ;Point ES at the int vector
                MOV     ES,AX                   ;  table at bottom of memory.

                MOV     WORD PTR [FIRST],0FFh   ;This instruction modifies it

;Check if int 9 and 16h vectors point to the resident copy.

                MOV     AX,DS                   ;Put seg of orig copy in AX
                CMP     AX,ES:[  9*4+2]         ;Compare it to int 9 seg
                JNE     INIT6                   ;Jump if different
                CMP     AX,ES:[16h*4+3]         ;Compare it to int 16h seg
                JNE     INIT6                   ;Jump if different

;Int 9 and 16h vectors point to resident copy.
;Restore int 9 and 16h vectors and release resident copy from memory.
;Then terminate.
```

(ALLKEYS.ASM continues)

■ UTILITIES

KEYS is toggled off, a keystroke will travel from the keyboard to ALLKEYS to the calendar to the BIOS to ALLKEYS to the notepad and finally to the application. When toggled on, however, ALLKEYS builds a bridge over the calendar and notepad, providing even their hotkeys safe passage to the application. Thus, the journey of a keystroke would be from the keyboard to ALLKEYS to the BIOS to ALLKEYS and then to the application, as illustrated in the "after" part of "How ALLKEYS Functions."

These are the operational fundamentals; programming for them requires a little more discussion.

Each time ALLKEYS is loaded, it must first determine whether or not it has been loaded before. It does this by calling the procedure SEC_COPY. This procedure simply searches through memory for the ALLKEYS copyright notice, which is left behind by the first load. If not found—that is, if this is the first load—the current interrupt 9 and 16h vectors are retrieved, using DOS function 35h (Get Interrupt Vector). These original vectors are saved as the addresses to which ALLKEYS will return if it is set to short-circuit the controlled group of TSRs. Having saved these vectors, ALLKEYS terminates, leaving itself resident in memory by using DOS's TSR function.

The pop-ups are then loaded. Each one will save the current vector of either interrupt 9 or 16h and substitute the address of its own routine. When ALLKEYS is then loaded the second time, it retrieves the now-modified interrupt 9 and 16h vectors and saves these, as well. These modified vectors are used by ALLKEYS to permit normal operation of the controlled TSRs.

```
                ASSUME    DS:NOTHING, ES:CSEG

                PUSH      DS                            ;Point ES at the resident
                POP       ES                            ;  copy of Allkeys.

                MOV       AX,2586H                      ;Restore interrupt 6
                MOV       DS,ES:[USED_INT9  ]
                MOV       DS,ES:[USED_INT9+2]
                INT       21H

                MOV       AX,2516H                      ;Restore interrupt 16h
                MOV       DS,ES:[USED_INT16  ]
                MOV       DS,ES:[USED_INT16+2]
                INT       21H

                MOV       AH,49H                        ;Have DOS release it from
                INT       21H                           ;  memory.

                ASSUME    DS:CSEG, ES:CSEG
                PUSH      CS                            ;Point DS back at our data
                POP       DS

                MOV       DX,OFFSET MESG5               ;Display status message.
OK_EXIT:        MOV       AH,6
                INT       21H

                MOV       AX,6C00H                      ;Terminate with no errorlevel
                INT       21H

;Int 9 and 16h vectors do not point to resident copy.
;Check if resident copy was only installed LOW.

INIT6:          CMP       USED_INT9,0                   ;Only installed LOW?
                JNE       INIT7                         ;Jump if not

;Allkeys only installed LOW.
;Just simply release it from memory and terminate.

                ASSUME    DS:CSEG, ES:CSEG

                PUSH      DS                            ;Point ES at the resident
                POP       ES                            ;  copy of Allkeys.
                PUSH      CS                            ;Point DS back to our data.
                POP       DS

                MOV       AH,49H                        ;Save DOS release it from
                INT       21H                           ;  memory.

                MOV       DX,OFFSET MESG5               ;Display OK message
                JMP       OK_EXIT                       ;  and terminate.

;Allkeys installed HIGH and LOW.
;Set DISABLE flag to disable Allkeys. Then terminate.

INIT7:          MOV       DISABLE,1                     ;Disable Allkeys

                MOV       DX,OFFSET MESG3               ;Print error message
                JMP       ERR_EXIT                      ;  and terminate.


;"/U" parameter wasn't entered. Check to see if Allkeys already loaded.

INIT6:          ASSUME    DS:CSEG, ES:CSEG

                CALL      SEC_COPY                      ;Check for a second copy
                JC        INIT9                         ;Jump if found

;Second copy not found.
;Release the environment to conserve memory.
;Save the current interrupts 9 and 16h. Then TSR.

                ASSUME    DS:CSEG, ES:NOTHING

                MOV       AX,WORD PTR DS:[2CH]          ;Release the environment.
                MOV       ES,AX
                MOV       AH,49H
                INT       21H

                MOV       AX,2586H                      ;Get interrupt 6
                INT       21H
                MOV       [ORIG_INT9  ],AX              ;Save the offset
                MOV       [ORIG_INT9+2],ES              ;Save the segment

                MOV       AX,3516H                      ;Get interrupt 16h
                INT       21H
                MOV       [ORIG_INT16  ],BX             ;Save the offset
                MOV       [ORIG_INT16+2],ES             ;Save the segment

                MOV       DX,OFFSET COPYRIGHT           ;Display copyright
                MOV       AH,9
                INT       21H

                MOV       AX,2168h                      ;Terminate and leave all
                MOV       DX,(OFFSET INIT - OFFSET CSEG + 15) SHR 4
                INT       21H                           ;  code but the init portion
                                                        ;  resident in memory. (TSR)

;Second copy was found.
;Make sure Allkeys not already installed high and low.

INIT9:          ASSUME    DS:CSEG, ES:CSEG

                PUSH      ES                            ;Point DS at the original
                POP       DS                            ;  copy of Allkeys.

                CMP       USED_INT9,0                   ;Already installed high & low?
                JE        INIT10                        ;Jump if not.

                MOV       DX,OFFSET MESG2               ;Display error message
                JMP       ERR_EXIT                      ;  and terminate.

;Obtain and save the used interrupts 9 and 16h to the original copy.

INIT10:         ASSUME    DS:CSEG, ES:NOTHING

                MOV       AX,2566H                      ;Get used interrupt 6
                INT       21H
                MOV       [USED_INT9  ],BX              ;Save the offset
                MOV       [USED_INT9+2],ES              ;Save the segment

                MOV       AX,2516H                      ;Get used interrupt 16h
                INT       21H
                MOV       [USED_INT16  ],AX             ;Save the offset
                MOV       [USED_INT16+2],ES             ;Save the segment

;Activate Allkeys by pointing interrupt vectors 6 and 16h
;to the resident copy's new interrupt 6 and 16h handlers.

                MOV       AX,2589H                      ;Set interrupt 6
                MOV       DX,OFFSET NEW_INT6
                INT       21H
                MOV       AX,2516H                      ;Set interrupt 16h
                MOV       DS,OFFSET NEW_INT16
                INT       21H

                MOV       DX,OFFSET MESG1               ;Display ready message
                JMP       OK_EXIT                       ;  and terminate.

INIT            ENDP

;-----------------------------------------------------------------------
; Routine to search through memory for a previous loaded copy of Allkeys.
; If found, on return, CF will be set and ES will point to previous copy.
;-----------------------------------------------------------------------
SEC_COPY        PROC      NEAR
                ASSUME    CS:CSEG, DS:CSEG, ES:NOTHING, SS:CSEG

                MOV       WORD PTR [FIRST],0            ;Modify to avoid false alarm
                MOV       AX,666h                       ;BX= start of our search
                MOV       AX,CS                         ;AX= end of our search
                CLD                                     ;Forward
NEXT_PARA:
                INC       AX                            ;Next paragraph
                CMP       AX,AX                         ;If current paragraph...
                MOV       ES,BX                         ;Set search segment
                JE        END_SEARCH                    ;...stop

                MOV       SI,OFFSET FIRST               ;Compare FIRST label
                MOV       DI,SI                         ;Offset is same
                MOV       CX,16                         ;Only FIRST 16 bytes
                REP       CMPSB                         ;Compare DS:SI TO ES:DI
                OR        CX,CX                         ;All matched?
                JNZ       NEXT_PARA                     ;No, keep on looking.

                STC                                     ;Found a copy in memory.
                RET                                     ;  Set CF and RETurn.

END_SEARCH:     CLC                                     ;Didn't find a copy.
                RET                                     ;  Clear CF and RETurn.

SEC_COPY        ENDP

CSEG            ENDS
                END       FIRST
```

(ALLKEYS.ASM ends)

ALLKEYS BY MODEM

The programs published in *PC Magazine* are available by modem from PC MagNet, an on-line service through which readers can discuss the columns with the editors.

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ALLKEYS.COM is already compiled and ready to run. ALLKEYS.BAS will automatically create ALLKEYS.COM when run once in BASIC. ALLKEYS.ASM allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM ALLKEYS;
LINK ALLKEYS;
EXE2BIN ALLKEYS ALLKEYS.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

ALLKEYS Command

Robert L. Morton 1988 No. 12 (Utilities)

Purpose: Alternately disables and enables the hotkeys used by pop-up utilities so these key combinations can be made available to application programs.

Format:

```
[d:][path]ALLKEYS

POP-UP #1

POP-UP #2

POP-UP #3

...

[d:][path]ALLKEYS
        or
[d:][path]ALLKEYS [/U]
```

Remarks: ALLKEYS must be loaded twice, once immediately before and once immediately after loading the series of memory-resident (TSR) utilities whose hotkeys are to be controlled. Normally, this would be done by making the appropriate entries in an AUTOEXEC.BAT file. After the second loading of ALLKEYS, the operation of the TSR programs in the controlled group is initially unaffected. Pressing Ctrl-Alt-Z, however, disables these pop-up programs by passing their trigger keys to an application program instead. Pressing Ctrl-Alt-Z a second time reenables operation of the controlled memory-resident pop-ups.

If no additional TSRs have been loaded subsequently, ALLKEYS may be completely uninstalled by entering the command with the /U parameter. This might be used from the DOS prompt to change the set of pop-ups controlled by ALLKEYS. If TSRs, e.g., *SideKick*, have been loaded after ALLKEYS, complete deinstallation is not possible, but the /U parameter will still disable ALLKEYS's operation.

When ALLKEYS is activated with Ctrl-Alt-Z, a series of beeps with a rising pitch is heard. A descending sequence of tones sounds when ALLKEYS is toggled off. Instructions for modifying these tones and for changing ALLKEYS's own Ctrl-Alt-Z hotkey are contained in the article.

■ UTILITIES

Once these vectors are pointed at ALLKEYS' replacement handlers, ALLKEYS simply terminates.

Now each time a key is pressed or released, the ALLKEYS interrupt 9 routine is invoked. This routine first inspects the key to see if it's the ALLKEYS hotkey. If not, ALLKEYS checks an internal flag for its on/off status. If the flag is on, ALLKEYS jumps to the original interrupt 9 handler, thus skipping over the pop-ups in between. If it's off, ALLKEYS jumps to the next handler down the line, thus allowing those pop-ups to check for their hotkeys, as normal. If the keystroke was indeed the ALLKEYS hotkey, the status flag is toggled to reflect the new status and the BEEP_STATUS routine is called to confirm it.

The ALLKEYS interrupt 16h handler is given to accommodate pop-ups that check for their hotkey using this interrupt. This routine checks ALLKEYS' status and then

```
100 REM - BASIC PROGRAM TO CREATE ALLKEYS.COM (PC Magazine June 28,1988)
110 CLS:PRINT "Creating ALLKEYS.COM": OPEN "ALLKEYS.COM" AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO 55: LINESUM#=0: LOCATE 2,3: PRINT "Countdown: " 55 - I;
140  FOR J = 1 TO 16 : READ EYTE$: CHECKSUM#=CHECKSUM#+VAL("&H"+EYTE$)
150   LINESUM#=LINESUM#+VAL("&H"+EYTE$)
160   IF (EYTE < 256) THEN LSET A$=CHR$(VAL("&H"+EYTE$)): PUT #1
170   NEXT J
180  READ LINETOT$: LINECHECK# = VAL("&H" + LINETOT$)
190  IF LINECHECK# = LINESUM# THEN GOTO 210
200  LOCATE 6,2: PRINT "Error in line #";200 + 10 * I
210 NEXT I
220 CLOSE: LOCATE 6,2: IF CHECKSUM# <> 76566 THEN GOTO 260
230 PRINT "ALLKEYS.COM  created successfully": SYSTEM
240 PRINT "ALLKEYS.COM  is not valid!": SYSTEM
250   DATA E9, 25,  2, 61, 6C, 4C, 4E, 45, 59, 53, 26, 31, 2E, 36, 20, 20, 61C
260   DATA 63, 20, 26, 31, 39, 36, 36, 26, 5A, 69, 66, 66, 26, 43, 6F, 6D, 474
270   DATA 6D, 75, 6B, 60, 63, 61, 76, 60, 6F, 6E, 73, 26, 43, 6F, 2E,  D, 5B7
280   DATA  A, 56, 43, 26, 6D, 61, 67, 61, 7A, 69, 6E, 65, 26, FE, 20, 52, 578
290   DATA 6F, 62, 65, 72, 76, 26, 4C, 2E, 26, 4D, 6F, 72, 74, 6F, 6B,  D, 562
300   DATA  A, 4C, 6F, 77, 26, 63, 6F, 70, 79, 20, 69, 6E, 73, 74, 61, 6C, 5C2
310   DATA 6C, 65, 66,  D,  A, 26, 61, 4C, 4C, 6E, 65, 50, 53, 20, 60, 69, 676
320   DATA 67, 66, 26, 63, 6F, 76, 79, 20, 69, 6E, 73, 76, 61, 6C, 6C, 65, 626
330   DATA 64,  D,  A, 43, 74, 72, 6C, 2D, 41, 6C, 74, 2D, 5A, 20, 76, 6F, 4B6
340   DATA 20, 76, 6F, 67, 67, 6C, 65, 26, 74, 73, 72, 27, 73, 26, 6F, 6B, 5B2
350   DATA 2F, 6F, 66, 66,  D,  A, 24, 61, 4C, 6C, 6E, 65, 59, 53, 20, 61, 43E
360   DATA 6C, 72, 65, 61, 66, 70, 20, 69, 6E, 73, 76, 61, 6C, 6C, 65, 64, 661
370   DATA 26, 66, 69, 67, 66, 26, 61, 6E, 64, 26, 6C, 6F, 77,  D,  A, 24, 4C6
380   DATA 56, 65, 63, 76, 6F, 72, 73, 26, 63, 6F, 75, 6C, 64, 26, 6B, 6F, 61A
390   DATA 74, 20, 62, 65, 26, 72, 65, 73, 74, 6F, 72, 65, 64, 26, 2D, 20, 556
400   DATA 61, 4C, 4C, 4E, 45, 59, 53, 26, 64, 69, 73, 61, 62, 6C, 65, 64, 56D
410   DATA  D,  A, 24, 41, 4C, 4C, 4E, 45, 59, 53, 26, 6E, 6F, 74, 26, 6C, 44D
420   DATA 6F, 61, 64, 65, 64, 26, 79, 65, 74,  D,  A, 24, 61, 4C, 4C, 4B, 4CE
430   DATA 45, 59, 53, 26, 75, 6E, 2D, 69, 6E, 73, 74, 61, 6C, 6C, 65, 64, 5E1
```

(ALLKEYS.BAS continues)

ALLKEYS.BAS: *A BASIC program that will automatically create ALLKEYS.COM.*

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```
440   DATA  D,  A, 24,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  3E
450   DATA  0,  0,  0, 2C,  C,  0,  0, F4,  1, DC,  5, F4,  1, 32,  0, FE, 438
460   DATA 58, 2E, 80, 3E, 46,  2,  0, 75, 22, E4, 60, 2E, 3A,  6, 43,  2, 412
470   DATA 75, 1F, E4,  2, CD, 16, 24,  F, 2E, 3A,  6, 44,  2, 75, 12, E8, 403
480   DATA A1,  0, 2E, 80, 36, 45,  2, FF, E8, 2F,  0, 58, 2E, FF, 2E, 3E, 5D0
490   DATA  2, 2E, 80, 3E, 45,  2,  0, 74, F2, 58, 2E, FF, 2E, 33,  2, FB, 57E
500   DATA 2E, 80, 3E, 46,  2,  0, 75,  D, 2E, 80, 3E, 45,  2,  0, 74,  5, 362
510   DATA 2E, FF, 2E, 37,  2, 2E, FF, 2E, 3F,  2, 51, 1E,  E, 1F, 80, 3E, 48A
520   DETE 45,  2,  0, 74, 14, 8E,  E, 47,  2, E8, 21,  0,  3,  E, 4B,  2, 318
530   DATA 3E,  E, 49,  2, 76, F3, EE, 12, 98, 8B,  E, 49,  2, E8,  D,  0, 563
540   DATA 2B,  E, 4B,  2, 3E,  E, 47,  2, 73, F3, 1F, 59, C3, 58, 51, 52, 4AC
550   DATA BA, 12,  0, E8, DE, 34, F7, F1, 8E, C8, 8A, C1, E6, 42, 8A, C5, 993
560   DATA E6, 42, E4, 61,  C,  3, E6, 61, 8E,  E, 4D,  2, E8,  A,  0, E4, 681
570   DATA 61, 24, FC, E6, 61, 5E, 59, 58, C3, 51, E9, FF,  0, E2, FE, 59, 8D8
580   DATA E2, F7, C3, E4, 61, 8A, E8,  C, 80, E6, 61, 8A, C4, EB,  0, E6, A3D
590   DATA 61, FA, E8, 20, E6, 20, FB, C3, EE, 80,  0, 80, 3C,  0, 75,  3, 761
600   DATA E9, 98,  0, 8A,  C, 32, ED, 46, FC, AC, 3C, 2F, 74,  5, E2, F9, 7E3
610   DATA E9, 88,  0, 80, 24, DF, 80, 3C, 55, 74,  3, EB, 7E, 90, E8, F0, 84D
620   DATA  8, 72,  C, BA,  3,  2, E4,  9, CD, 21, E8,  1, 4C, CD, 21,  6, 4E1
630   DATA 1F, 33, C8, 8E, C0, C7,  6,  8,  1, FF,  0, 8C, D8, 26, 3E,  6, 5F8
640   DATA 26,  8, 75, 39, 26, 3E,  6, 5A,  8, 75, 32, 1E,  7, E8,  9, 25, 347
650   DATA 26, 8B, 16, 3E,  2, 26, 8E, 1E, 3D,  2, CD, 21, E8, 16, 25, 26, 41C
660   DATA 8E, 16, 3F,  2, 26, 8E, 1E, 41,  2, CD, 21, E4, 49, CD, 21,  E, 4DE
670   DATA 1F, BA, 1C,  2, E4,  9, CD, 21, E8,  8, 4C, CD, 21, 83, 3E, 3E, 598
680   DATA  2,  8, 75,  D, 1E,  7,  E, 1F, E4, 49, CD, 21, BA, 1C,  2, EE, 484
690   DATA E3, C6,  6, 46,  2,  1, BA, D8,  1, EB, 8E, E8, 73,  8, 72, 32, 6F8
700   DATA A1, 2C,  8, 8E, C8, E4, 49, CD, 21, E8,  9, 35, CD, 21, 89, 1E, 691
710   DATA 33,  2, 8C,  6, 35,  2, B8, 16, 35, CD, 21, 89, 1E, 37,  2, 8C, 45E
720   DATA  6, 39,  2, BA,  3,  1, E4,  9, CD, 21, E8,  8, 31, BA, 33,  8, 488
730   DATA CD, 21,  6, 1F, 83, 3E, 3E,  2,  8, 74,  6, BA, A7,  1, E9, 45, 51B
740   DATA FF, E8,  8, 35, CD, 21, 89, 1E, 3B,  2, 8C,  6, 3D,  2, E8, 16, 566
750   DATA 35, CD, 21, 89, 1E, 3F,  2, 8C,  6, 41,  2, E8,  9, 25, BA, 4F, 4CF
760   DATA  2, CD, 21, E8, 16, 25, BA, 8F,  2, CD, 21, BA, 66,  1, E9, 63, 689
770   DATA FF, C7,  6,  8,  1,  8,  8, BB,  8,  6, 8C, C8, FC, 43, 3E, C3, 61F
780   DATA 8E, C3, 74, 10, EE,  8,  1, 8E, FE, E9, 10,  8, F3, A6,  E, C9, 753
790   DATA 75, EE, F9, C3, F8, C3,  8,  8,  8,  8,  8,  8,  8,  8,  8,  8, 4D7
```

(ALLKEYS.BAS ends)

transfers control. When on, ALLKEYS will jump to the original interrupt 16h. When ALLKEYS is off, control is passed, as it would normally be, to the next pop-up down the line.

The BIOS provides a means of beeping the speaker by printing a character 7 (BELL), using interrupt 10h function 0Eh. Unfortunately, however, using this technique there is no way to produce a specific frequency for a specific time period. Therefore, as shown in the .ASM listing, ALLKEYS incorporates its own routines to produce the on/off status tones.

To accommodate uninstallation, ALLKEYS checks for the /U parameter during initialization. If /U is found, ALLKEYS checks to see if it is loaded by calling procedure SEC_COPY. If it is, it checks to determine if a second copy is also installed. If it isn't, ALLKEYS releases the first copy from memory. If it is installed, ALLKEYS checks to make sure the inter-

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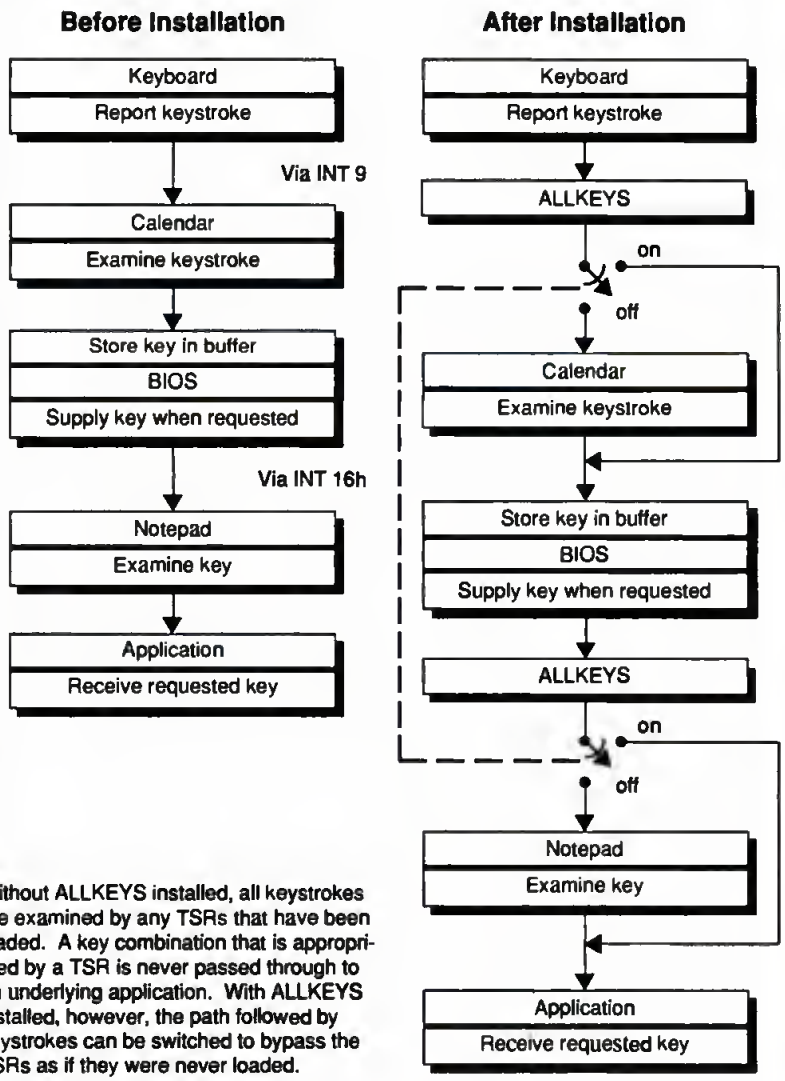
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rupt vectors 9 and 16h still point to ALLKEYS' own keyboard handlers. If they don't, ALLKEYS sets an internal flag to disable itself. (Notice variable DISABLE at the beginning of the assembly language listing.) If the vectors do point to ALLKEYS' handlers, they are pointed back to the TSR-modified interrupt 9 and 16h vectors, thus removing ALLKEYS from the pop-up chain. ALLKEYS then releases itself from memory to complete the process.

If you followed the logic in the above explanation, you'll know why ALLKEYS cannot point the interrupt 9 and 16h vectors to the modified ones if any other pop-ups have been loaded after it. It's because to do so would mean removing those pop-ups, in addition to ALLKEYS, from the pop-up chain. To avoid doing this, ALLKEYS has built into it a disable mechanism. Whenever an interrupt 9 or 16h is being processed, ALLKEYS will first check variable DISABLE. When set to one, ALLKEYS will not respond to the Ctrl-Alt-Z combination and will allow all keystrokes to be processed normally.

How ALLKEYS Functions



Without ALLKEYS installed, all keystrokes are examined by any TSRs that have been loaded. A key combination that is appropriated by a TSR is never passed through to an underlying application. With ALLKEYS installed, however, the path followed by keystrokes can be switched to bypass the TSRs as if they were never loaded.

MODIFYING ALLKEYS If you find ALLKEYS' hotkey combination, Ctrl-Alt-Z, hard to remember or are uncomfortable with the on/off status tones, you can personalize ALLKEYS to suit your needs. By changing the values of particular variables in the assembler listing, you can efficiently produce a customized version of ALLKEYS, and even if you don't have an assembler, you can still patch ALLKEYS with DEBUG.

Two variables at the beginning of the assembly language listing, HOTKEY and SHIFT_MASK, determine the exact ALLKEYS hotkey. The variable HOTKEY sets the "make-scan code" of the key. This is the number the keyboard sends to the BIOS keyboard handler when a key is pressed. The table "Keyboard Scan Codes for Altemative Hotkeys" contains all of the "make" scan code values and their corresponding keys.

Variable SHIFT_MASK corresponds to the shift keys: Alt, Ctrl, Left Shift, and Right Shift. The value for this variable is determined by which shift keys must be pressed simultaneously with the hotkey, to toggle ALLKEYS on and off. The "SHIFT_MASK Value Table" contains all possible shift-key combinations and their corresponding values.

To change the ALLKEYS hotkey by reassembling with either the IBM or Microsoft macro assembler, simply substitute the new values for HOTKEY and SHIFT_MASK in the assembly program. Then from the DOS prompt, enter

```
MASM ALLKEYS;
LINK ALLKEYS;
EXE2BIN ALLKEYS ALLKEYS.COM
```

To change the ALLKEYS hotkey using DEBUG, you'll need to substitute the new HOTKEY code where you see SS and the new SHIFT_MASK value where you see MM in the script shown below. One convenient feature of this process is that it's not necessary to type in anything to the right of the semicolons.

```
DEBUG ALLKEYS.COM
E 243 SS            ;Scan code
E 244 MM            ;Shift mask
W
Q
```

The ALLKEYS on/off status tones are determined by the variables TONE_LOW,



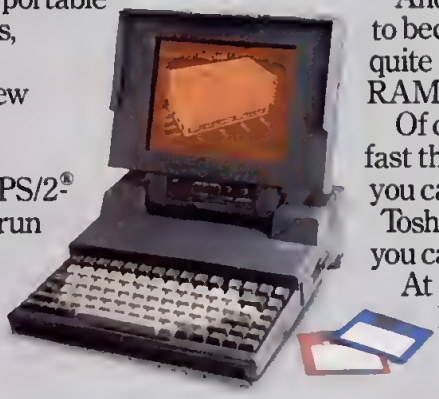
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TONE_HIGH, TONE_STEP, and TONE_LENGTH. These variables are also located at the beginning of the assembly language listing. When ALLKEYS is toggled on, the variable TONE_LOW sets the starting frequency of the ascending tone sequence and the variable TONE_HIGH marks its end. When ALLKEYS is toggled off, TONE_HIGH marks the starting frequency of the descending tone sequence and TONE_LOW marks the ending. To move the two boundaries, substitute a value between 37 and 32767 for TONE_LOW and TONE_HIGH. TONE_HIGH should be at least equal to TONE_LOW plus 1.

The variable TONE_STEP determines the size of the steps ALLKEYS takes between tones when ascending or descending between boundaries set by TONE_LOW and TONE_HIGH. To change the step, substitute a value between 1 and 65535 for TONE_STEP.

Finally, the variable TONE_LENGTH sets the length of the individual tones. To change the length of each tone, substitute a value between 1 and 65535 for TONE_LENGTH.

For users patching with DEBUG, in the script below, LL corresponds to the low boundary, HH to the high boundary, SS to the step, and NN to the length of each tone. However, you'll need a decimal conversion table or a scientific calculator to convert these values to hexadecimal before substituting. *SideKick* users will find their pop-up calculators handy for this.

```
DEBUG ALLKEYS.COM
E 247 LL              ;Tone Low
E 249 HH              ;Tone High
E 24B SS              ;Tone Step
E 24D NN              ;Tone Length
W
Q
```

(Note: Because a word is stored backwards in memory, least significant byte first, you must enter the bytes backwards. For example, to change TONE_STEP (SS) to 500, you would first convert it to its hexadecimal equivalent, 01F4. Then, you would enter "F4 01" for SS. DEBUG also requires that you enter the space between bytes.)

Here are a few examples you can try:

```
LL = F4 01
HH = DC 05
SS = 32 00
NN = 05 00
```

creates a synthesized effect;

```
LL = 30 75
HH = 31 75
SS = 01 00
NN = 01 00
```

turns off the status tones;

```
LL = 64 00
HH = BC 02
SS = 59 02
NN = 64 00
```

creates a one-tone status.

As our RAM-resident utility libraries expand, so do the demands for fully functioning keys. While supplementing applications, pop-ups shouldn't cripple the user interface. By separating the two procedures, ALLKEYS gives you back your whole keyboard when you need it, yet doesn't compromise or impact on your full use of pop-ups. Once you start using ALLKEYS, you'll wonder how you ever got along without it. PC

Robert L. Morton is a systems analyst in Indio, California.

Keyboard Scan Codes for Alternative Hotkeys

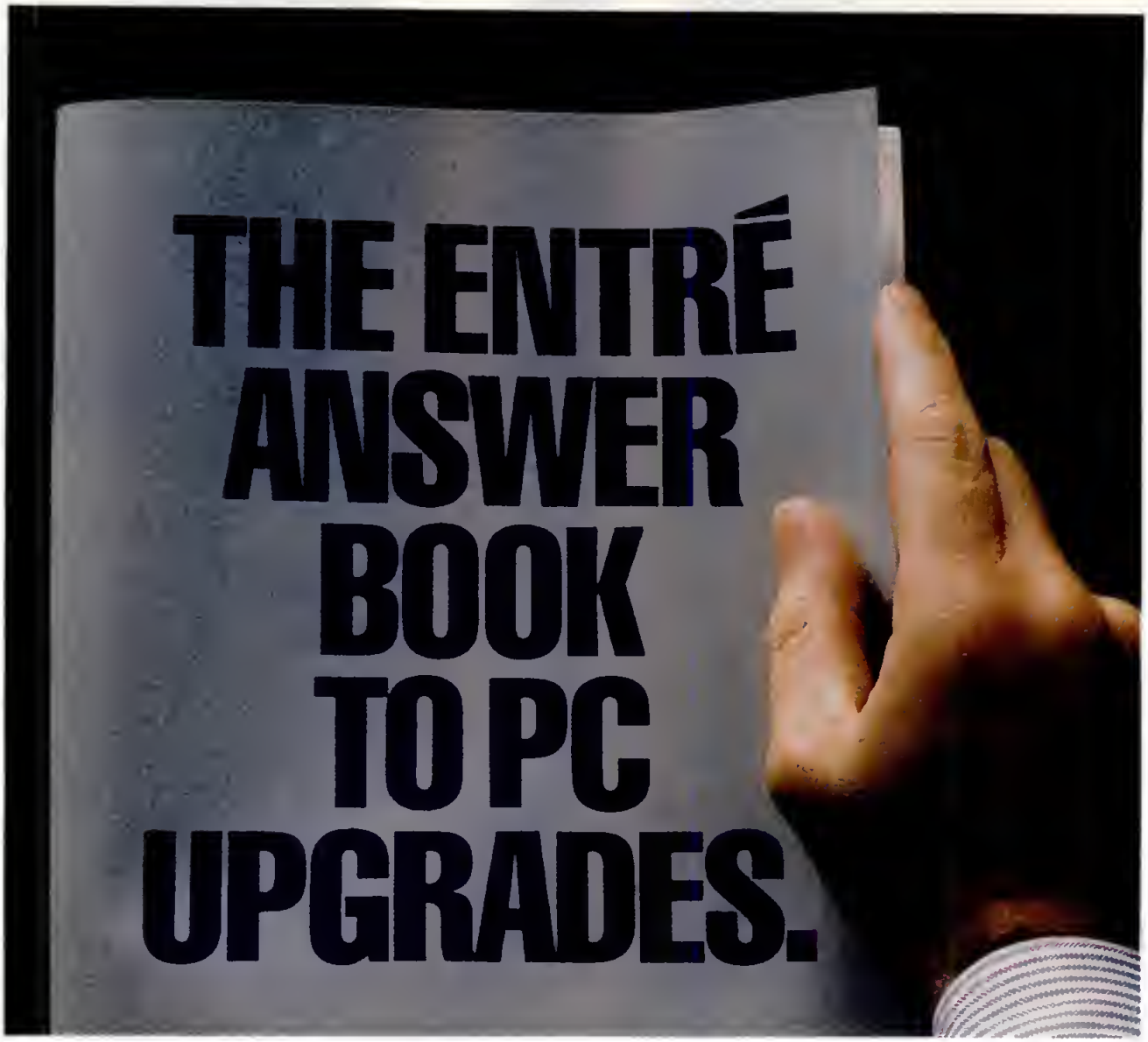
Key	Scan code in hex	Key	Scan code in hex
Esc	01	Z	2C
!1	02	X	2D
@2	03	C	2E
#3	04	V	2F
$4	05	B	30
%5	06	N	31
^6	07	M	32
&7	08	<,	33
*8	09	>.	34
(9	0A	?/	35
)0	0B	Right Shift	36
_-	0C	PrtSc*	37
+=	0D	Alt	38
Backspace	0E	Spacebar	39
Tab	0F	CapsLock	3A
Q	10	F1	3B
W	11	F2	3C
E	12	F3	3D
R	13	F4	3E
T	14	F5	3F
Y	15	F6	40
U	16	F7	41
I	17	F8	42
O	18	F9	43
P	19	F10	44
{[	1A	NumLock	45
}]	1B	ScrollLock	46
Enter	1C	7 Home	47
Ctrl	1D	8 Up Arrow	48
A	1E	9 PgUp	49
S	1F		4A
D	20	4 Left Arrow	4B
F	21	5	4C
G	22	6 Right Arrow	4D
H	23	+	4E
J	24	1 End	4F
K	25	2 Down Arrow	50
L	26	3 PgDn	51
:;	27	0 Ins	52
"'	28	Del	53
~`	29	SysReq	54
Left Shift	2A	F11	57
\|	2B	F12	58

If the key combination that activates the program is not to your liking, it con be changed. Choose o hotkey from the table above and substitute its scan code in the program.

SHIFT_MASK Value Table

SHIFT_MASK value	Shift key (● = Pressed) Alt	Ctrl	Left Shift	Right Shift
0				
1				●
2			●	
3			●	●
4		●		
5		●		●
6		●	●	
7		●	●	●
8	●			
9	●			●
A	●		●	
B	●		●	●
C	●	●		
D	●	●		●
E	●	●	●	
F	●	●	●	●

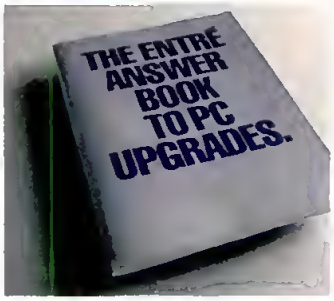
The combination of shift keys needed to pop the progrom up corresponds to o unique SHIFT_MASK volue. Use this value when altering the program's default activation keys as exploined in the orticle.



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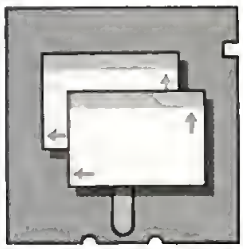
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■ ENVIRONMENTS ■ CHARLES PETZOLD

MULTIPLE THREADS MAKE BETTER OS/2 PROGRAMS



With DOS, idle computer time is simply wasted. But two practical OS/2 programs show how better performance, using OS/2's ability to multitask, can be achieved.

I'm still hearing arguments that multitasking is unnecessary on a single-user personal computer, since people can do only one thing at a time, and that multitasking slows down the PC because when two or more programs run at the same time, each runs at half speed. Hence, the arguers conclude, OS/2 is unnecessary and even detrimental.

What a superficial analysis of multitasking! The whole point of multitasking is to make more-efficient use of time. Multitasking is valuable on personal computers specifically because it can effectively speed up the system by doing work in what would otherwise be dead time.

Let me illustrate this by presenting two concrete examples. One uses the OS/2 DETACH command in a batch file, and the other constitutes a complete OS/2 utility that uses multiple threads to increase its speed and efficiency.

BACKGROUND FILE COPYING The OS/2 DETACH command runs programs or commands in the background. Programs that are detached cannot read keyboard or mouse input and they cannot write anything to the screen (unless they install monitors or use VioPopUp), but

```
;-----------------------------------------
; FSB.ASM -- "File Search and Browse" for OS/2
;            (c) 1988, Ziff Communications Co.
;            PC Magazine * Charles Petzold, 3/88
;-----------------------------------------

.286P

;-------------------------------------------------------
; Macro to call OS/2 functions without declaring them first
;-------------------------------------------------------

OS2Call         MACRO   fnctname

                IFNDEF  fnctname
                EXTRN   fnctname:FAR
                ENDIF

                Call    Far Ptr fnctname

                ENDM

;-----------------------------------
; Structures used in OS/2 functions
;-----------------------------------

FileFindBufStr  STRUC
                create_date     dw      ?
                create_time     dw      ?
                access_date     dw      ?
                access_time     dw      ?
                write_date      dw      ?
                write_time      dw      ?
                file_size       dd      ?
                fallo_size      dd      ?
                attributes      dw      ?
                string_len      db      ?
                file_name       db      13 dup (?)
FileFindBufStr  ENDS

KeyDataStruc    STRUC
                char_code       db      ?
                scan_code       db      ?
                status          db      ?
                nls_shift       db      ?
                shift_state     dw      ?
                time            dd      ?
KeyDataStruc    ENDS

ModeDataStruc   STRUC
                md_length       dw      ?
                md_type         db      ?
                color           db      ?
                col             dw      ?
                row             dw      ?
                hres            dw      ?
                vres            dw      ?
ModeDataStruc   ENDS

;-----------------------------------
; Define all segments and DGROUP
;-----------------------------------

_TEXT           SEGMENT WORD PUBLIC 'CODE'
_TEXT           ENDS

_DATA           SEGMENT WORD PUBLIC 'DATA'
_DATA           ENDS

_BSS            SEGMENT WORD PUBLIC 'BSS'
_BSS            ENDS

STACK           SEGMENT PARA STACK 'STACK'
                dw      1024 dup (?)
STACK           ENDS

DGROUP          GROUP   _DATA, _BSS, STACK

                ASSUME  CS:_TEXT, DS:DGROUP, SS:DGROUP, ES:DGROUP

;----------------------------
; Initialized Data Segment
;----------------------------

_DATA           SEGMENT

SyntaxMsg       db      13, 10, "Syntax: FSB filespec"
                db      13, 10
                db      13, 10, "File Search and Browse "
                db              "(c) 1988, Ziff Communications Co."
                db      13, 10, "PC Magazine ", 254," Charles Petzold, 3/88"
CRLF            db      13, 10, 0

DriveError      db      "FSB: Invalid disk drive", 0
StartDirError   db      "FSB: Invalid directory", 0
FileFindError   db      "FSB: Invalid file spec", 0
PipeError       db      "FSB: Cannot not create pipe", 0
ThreadError     db      "FSB: Cannot not create second thread", 0
FileOpenError   db      0, "FSB: Cannot open file for reading", 13, 10, 0
VideoModeError  db      0, "FSB: Unsupported video mode", 13, 10, 0

RootDir         db      "\", 0
Delimiters      db      9, " ,;=", 0
DoBrowse        db      1

_DATA           ENDS

;------------------------------
; Uninitialized Data Segment
;------------------------------
```

(continues)

Figure 1: *The assembly language listing FSB.ASM for the multithread OS/2 File Search and Browse utility.*

■ ENVIRONMENTS

they can make use of almost any other OS/2 function.

One nice use for the OS/2 DETACH command is in batch files. To put it in context, let's start from the fact that most OS/2 users will have an OS2INIT.CMD batch file. This file is the OS/2 equivalent of AUTOEXEC.BAT, and it's listed in the PROTSHELL statement in your CONFIG.SYS file. When you start a new OS/2 Command Prompt session, OS/2 loads CMD.EXE, and CMD.EXE executes OS2INIT.CMD. At the very least, OS2INIT.CMD will contain PATH and SET statements to set up the environment for that session.

You can also keep a STARTUP.CMD file in the root directory of your boot disk. Without such a file, OS/2 leaves you in the Program Selector when you boot up. If you do have a STARTUP.CMD file in the root directory, OS/2 loads an initial copy of CMD.EXE at boot time. This CMD.EXE executes STARTUP.CMD and leaves you at the OS/2 command line.

■ If you have placed a STARTUP.CMD file in the root directory, OS/2 loads an initial copy of CMD.EXE at boot time.

Typically, STARTUP.CMD contains commands that need to be executed only once when you boot up. The last line of STARTUP.CMD usually consists of the statement

```
OS2INIT
```

which runs the normal initialization batch file for that particular session.

A couple of months ago I added more memory to my system and decided to use some of it for a RAMdisk to hold programs and other files I use a lot. The RAMdisk on my system is drive E:, so I added a bunch of COPY statements to my STARTUP.CMD file to copy files from the hard disk to the RAMdisk. My STARTUP.CMD file then looked like this:

```
COPY file1 E:
COPY file2 E:
    ...
OS2INIT
```

Every time I booted up I had to wait for all the files to be copied before getting to the OS/2 command line.

I had my system running like this for several weeks before it dawned on me that OS/2 offered a better solution. I put all the COPY commands in a separate batch file named RAMCOPY.CMD and changed

```
_BSS            SEGMENT

FileSpec        dw      ?, ?
LastBackSlash   dw      ?
PipeReadHandle  dw      ?
PipeWriteHandle dw      ?
ThreadID        dw      ?
ThreadStack     dw      1024 dup (?)
PullFileName    db      80 dup (?)
BytesRead       dw      ?
BytesWritten    dw      ?

_BSS            ENDS

;---------------
; Code Segment
;---------------

_TEXT           SEGMENT

;-----------------------------------------------
; Parse command line to get file specification
;-----------------------------------------------

Entry:          Push    DS                      ; Data segment selector
                Pop     ES                      ; Transfer it to ES
                Mov     DS, AX                  ; DS = Environment selector
                Mov     SI, BX                  ; SI = Start of command line
                                                ; Skip name and delimiters
                                                ; ------------------------

SkipProgName:   Lodsb                           ; Pull a command line byte
                Or      AL, AL                  ; Check if it's zero
                Jne     SkipProgName            ; If not, continue

SkipDelim:      Lodsb                           ; Get command line byte
                Or      AL, AL                  ; See if it's zero
                Jnz     CheckDelim              ; If not, check for delimiter

                Jmp     DoSyntaxMsg             ; If so, display message

CheckDelim:     Mov     CX, 5                           ; Five delimiters
                Mov     DI, Offset DGROUP:Delimiters    ; pointer to them
                Repne   Scasb                   ; scan for delimiter
                Je      SkipDelim               ; If delimiter, loop around

                                                ; Possibly change disk drive
                                                ; ---------------------------

                Cmp     Byte Ptr [SI], ':'      ; Check if a drive present
                Jne     NoDiskDrive             ; If not, skip section

                And     AL, 0DFh                ; Capitalize it
                Sub     AL, '@'                 ; Change from A to 1, etc
                Sub     AH, AH                  ; Zero out top byte

                Push    AX                      ; Change to that drive
                Os2Call DosSelectDisk           ;    by calling OS/2

                Mov     DX, Offset DGROUP:DriveError
                Or      AX, AX                  ; If AX not zero,
                Jnz     ErrorExit               ;    display message and exit

                Add     SI, 2                   ; Skip past drive
NoDiskDrive:    Dec     SI                      ; First character of rest

                Mov     ES:[FileSpec], SI       ; Save the address

                Mov     ES:[FileSpec + 2], DS

FindEnd:        Lodsb                           ; Get a byte
                Cmp     AL, '\'                 ; Check if it's a backslash
                Jnz     NotBackSlash            ; If not, continue

                Mov     DS:[LastBackSlash], SI  ; If so, save the address

NotBackSlash:   Mov     CS, 8                   ; now six delimiters
                Mov     DI, Offset DGROUP:Delimiters    ; pointer to delimiters
                Repne   Scasb                   ; scan them
                Jnz     FindEnd                 ; If not delimiter, loop around

                Mov     Byte Ptr [SI-1], 0      ; terminate with zero

                                                ; Possibly change directory
                                                ; --------------------------

DoChangeDir:    Mov     SI, ES:[LastBackSlash]  ; Address of last back slash
                Or      SI, SI                  ; See if any at all
                Jz      NoChangeDir             ; If none, skip this section

                Dec     SI                      ; Points to last backslash now
                Cmp     SI, ES:[FileSpec]       ; Check if at beginning
                Jnz     ChangeToDir             ; If not, use directory

                Inc     Word Ptr ES:[FileSpec]  ; Skip past initial backslash
                Push    DGROUP                  ; Segment of new dir
                Push    Offset DGROUP:RootDir   ; Offset of new dir
                Jmp     Short CallChangeDir     ; Change to root directory

ChangeToDir:    Mov     Byte Ptr [SI], 0        ; Terminate dir name with zero
                Push    Word Ptr ES:[FileSpec + 2]      ; This is segment
                Push    Word Ptr ES:[FileSpec]          ; This is offset

                Inc     SI                      ; Save address of filename
                Mov     ES:[FileSpec], SI       ;    in FileSpec

CallChangeDir:  Push    0                       ; Reserved bytes
                Push    0
                Os2Call DosChdir                ; Change directory

                Mov     DX, Offset DGROUP:StartDirError
                Or      AX, AX                  ; If non-zero return code,
                Jne     ErrorExit               ;    display message and leave

                                                ; Call Main Routine and exit
                                                ; ---------------------------

NoChangeDir:    Push    DS                      ; Set DS to data segment
                Pop     ES

                Call    MainRoutine             ; Go!

                Push    1                       ; All threads to terminate
                Push    0                       ; Return code
                Os2Call DosExit                 ; End the program

;---------------------------------------
; Error Exit: DS is pointer to string
;---------------------------------------

DoSyntaxMsg:    Mov     DX, Offset DGROUP:SyntaxMsg

ErrorExit:      Mov     AX, DGROUP              ; Set DS to data segment
                Mov     DS, AX
```

(Figure 1 continues)

my.STARTUP.CMD file to read

```
DETACH RAMCOPY
OS2INIT
```

Now all the files are copied in the background. I no longer have to wait for the COPY commands to finish before getting to the OS/2 command line.

(If you choose to boot up to the Program Selector, you won't have a STARTUP.CMD file. However, you can do something similar in CONFIG.SYS by using the statement

```
RUN = CMD.EXE /C RAMCOPY.CMD
```

Like DETACH, the CONFIG.SYS RUN statement runs a program in a detached state.)

Obviously, this little trick saves only a few seconds of objective time when you boot up, but if you've ever vocally urged your DOS AUTOEXEC.BAT file to get a move on so you can get to work, you'll appreciate just how subjectively valuable this time is.

SEARCH AND BROWSE As I discussed in my March 15 and March 29, 1988, columns, an OS/2 program can create multiple threads of execution. Multiple threads are different sections of a program that run concurrently. This is a way in which a program can multitask with itself. OS/2 supports multiple threads through the DosCreateThread function. Structurally, a thread looks like a function in your program.

Used creatively, multiple threads are one of several OS/2 features that will give us better applications than those we've seen under DOS. As you begin to work with multiple threads, you'll see solutions to problems that never seemed like problems, because they were facts of life under a single-tasking operating system. Let's examine an everyday problem.

If you need to find all files on your hard disk that match a particular file specification ("*.ASM", for example), you probably use John Socha's classic WHEREIS program, or Peter Norton's FILEFIND, or something similar. These programs give you a simple list of fully qualified filenames that match the specification.

After you get the list of files, you may also want to look at their contents. For that, you would use an editor or my BROWSE program (Programming/Utilities, March 25, 1986), or something similar. Such programs display a file on the screen and let you page up and down through it.

Surely it would be nice to combine these two utilities into one program that would both find all files matching a file specification and let you browse through them sequentially as they were found.

Such a program could certainly be written for DOS. But think about how it would

```
                Mov     BX, 2                   ; Standard Error handle
                Call    StringLen               ; Get length of DX string
                Mov     CX, AX                  ; Move it to CX
                Call    MyDosWrite              ; Display error message

                Push    1                       ; All threads to terminate
                Push    1                       ; Error return code
                Os2Call DosExit                 ; End the program

;-------------------------------------------------------------
; Main Routine, create pipe, start second thread, and do browses
;-------------------------------------------------------------

MainRoutine:    Push    DS                      ; Address for read handle
                Push    Offset DGROUP:PipeReadHandle
                Push    DS                      ; Address for write handle
                Push    Offset DGROUP:PipeWriteHandle
                Push    16384                   ; Size of pipe
                Os2Call DosMakePipe             ; Create it

                Mov     DX, Offset DGROUP:PipeError
                Or      AX, AX                  ; If non-zero return code,
                Jnz     ErrorExit               ;    depart from program

                Push    CX                      ; Address of second thread
                Push    Offset _TEXT:SecondThread
                Push    DS                      ; Address for thread ID
                Push    Offset DGROUP:ThreadID
                Push    DS                      ; Top of thread stack
                Push    Offset DGROUP:ThreadStack + 2048
                Os2Call DosCreateThread         ; Create the thread

                Mov     DX, Offset DGROUP:ThreadError
                Or      AX, AX                  ; Again, if error code,
                Jnz     ErrorExit               ;    get out of this place

StartPipeRead:  Mov     CX, 80                  ; Read 80 chars from pipe
                Mov     DX, Offset DGROUP:FullFileName  ; Store it here

ReadPipe:       Mov     AX, [PipeReadHandle]    ; Pipe handle
                Call    MyDosRead               ; Read it

                Cmp     [BytesRead], 0          ; Check if read no bytes
                Jz      NothingLeft             ; If so, pipe is empty

                Add     DX, [BytesRead]         ; Increment destination ptr
                Sub     CX, [BytesRead]         ; Decrement counter
                Jnz     ReadPipe                ; If not 80 bytes, read again

                Mov     DX, Offset FileFindError
                Cmp     [FullFileName], 0       ; See if file name present
                Jz      ErrorExit               ; If not, thread had problem

NoErrFromThread:Mov     BX, 1                   ; Standard output handle
                Mov     DX, Offset DGROUP:FullFileName  ; Full file name
                Call    StringLen               ; Get its length
                Mov     CX, AX                  ; Store in CX
                Call    MyDosWrite              ; Write to standard output

                Mov     CX, 2                   ; Two bytes
                Mov     DX, Offset DGROUP:CRLF  ;    for carriage ret/line feed
                Call    MyDosWrite              ; Write that out also

                Cmp     [DoBrowse], 1           ; See if still doing browse
                Jnz     StartPipeRead           ; If not, skip the call

                Call    Browse                  ; Browse the file

                Or      AX, AX                  ; If zero returned, continue
                Jz      StartPipeRead

                Cmp     AX, -1                  ; If -1, Esc pressed -->
                Jz      NothingLeft             ;   terminate gracefully

                Cmp     AX, Offset DGROUP:VideoModeError
                Jnz     ShowBrowseErr           ; If video mode error,
                Mov     [DoBrowse], 0           ;    don't try browse again

ShowBrowseErr:  Mov     BX, 2                   ; Standard error output
                Mov     DX, AX                  ; Address of error message
                Call    StringLen               ; Find length
                Mov     CX, AX                  ;    and save in CX
                Call    MyDosWrite              ; Dispay the string

                Jmp     StartPipeRead           ; And get another file name

NothingLeft:    Ret                             ; Return when all done

;-------------------------------------------------------------------------
; DosRead and DosWrite routines (AX is handle, DX is buffer, CX is length)
;-------------------------------------------------------------------------

MyDosRead:      Push    AX                      ; Input handle
                Push    DS                      ; Segment of buffer
                Push    DX                      ; Offset of buffer
                Push    CX                      ; Number of bytes to write
                Push    DS                      ; Segment for bytes read
                Push    Offset DGROUP:BytesRead ; Offset for bytes read
                Os2Call DosRead                 ; Read
                Ret

MyDosWrite:     Push    BX                      ; Output handle
                Push    DS                      ; Segment of buffer
                Push    DX                      ; Offset of buffer
                Push    CX                      ; Number of bytes to write
                Push    DS                      ; Segment for bytes written
                Push    Offset DGROUP:BytesWritten      ; Offset for written
                Os2Call DosWrite                ; Write
                Ret

;-------------------------------------------------------------
; StringLen routine (DS:DX points to strieg, AX is returned)
;-------------------------------------------------------------

StringLen:      Push    ES                      ; Save some registers
                Push    DI
                Push    CX

                Push    DS
                Pop     AX                      ; Set ES to DS
                Mov     DI, DX                  ; Set DX to address of string
                Mov     CX, -1                  ; Initialise CX to big number
                Sub     AL, AL                  ; Search for zero
                Repne   Scasb                   ; Do the scan
                Not     CX                      ; Invert CX
                Dec     CX                      ; Take away one
                Mov     AX, CX                  ; That's the length

                Pop     CX                      ; Restore saved registers
                Pop     DI
                Pop     ES
                Ret

_TEXT           ENDS
```

(Figure 1 continues)

■ ENVIRONMENTS

work. As soon as the program found a matching file, it would stop the file search, display the file on the screen, and allow you to browse through it. Only after you stopped browsing would the program resume its search for more matching files, and every time the program searched, you'd sit there waiting for the next match. The DOS program would be structured this way because DOS is a single-tasking operating system. A program cannot use DOS to do a file search while also interacting with the user in a file browse.

But under OS/2 there's no reason why the program has to stop the file search while you're browsing a file. If the file search executed as a second thread of execution, it could continue running during the file browse. Thus, the time you would have to wait for the next found file would be greatly reduced. From the user perspective, the program would run faster.

Here's an OS/2 utility program that uses multiple threads to effect faster program execution. The assembly language listing for FSB ("File Search and Browse") is shown in Figure 1; a BASIC program that you can type in and run to create FSB.EXE is shown in Figure 2.

CREATING FSB To create FSB.EXE from FSB.ASM, you can use Microsoft's Macro Assembler, Version 4.0 or 5.0 (under real mode); IBM's new Macro Assembler/2 (under real mode or protected mode); or Microsoft's protected-mode Macro Assembler 5.1 (not officially released at the time of this writing). You run

```
MASM FSB;
```

Do not use any Microsoft Macro Assembler prior to Version 4.0 or IBM's Macro Assembler, Versions 1.0 or 2.0. These versions of the assembler either do not support the 80286 instruction set or have bugs in the push-immediate instruction.

To link the program, using the LINK.EXE and DOSCALLS.LIB files supplied with the retail version of OS/2, you must enter

```
LINK FSB, /ALIGN:16, NUL, DOSCALLS;
```

If necessary, set your LIB environment variable to indicate the directory in which DOSCALLS.LIB is stored. (Both the FSB.ASM and FSB.EXE files are available for downloading from PC MagNet, as explained in the sidebar "ALLKEYS by Modem," which accompanies this issue's Utilities column.)

```
;-----------------------------------------------------------------------
;-----------------------------------------------------------------------
; SECOND THREAD section to search for files and write to pipe
;-----------------------------------------------------------------------
;-----------------------------------------------------------------------

;-----------------------------------------
; Initialized Data Segment for Second Thread
;-----------------------------------------

_DATA           SEGMENT

BackDir         db      "..", 0
StarDotStar     db      "*.*", 0

_DATA           ENDS

;-------------------------------------------
; Uninitialized Data Segment for Second Thread
;-------------------------------------------

_BSS            SEGMENT

FileFindBuf     FileFindBufStr <>
FileFindBufLen  equ     $ - FileFindBuf

PullPathName    Label   Byte
CurrentDisk     db      ?, ?, ?
CurrentDir      db      64 dup (?)
CurrDirLen      dw      ?
Zeroes          db      80 dup (?)
DriveMap        dd      ?

_BSS            ENDS

;---------------------------------
; Code Segment for Second Thread
;---------------------------------
_TEXT           SEGMENT

;-----------------------------------------------------
; Second Thread -- Calls FindThem, closes pipe, and exits
;-----------------------------------------------------

SecondThread:   Push    DS                              ; Variable to receive
                Push    Offset DGROUP:CurrentDisk       ;   current drive
                Push    DS                              ; Variable to receive
                Push    Offset DGROUP:DriveMap          ;   drive map
                Os2Call DosQCurDisk

                Add     [CurrentDisk], '@'              ; Convert to letter
                Mov     [CurrentDisk + 1], ':'          ; Follow by colon
                Mov     [CurrentDisk + 2], '\'          ;   and backslash

                Call    FindThem                ; Do the finds

TerminateThread:Push    [PipeWriteHandle]       ; Close the pipe for writing
                Os2Call DosClose

                Push    0                       ; Terminate this thread only
                Push    0                       ; Result code (ignored)
                Os2Call DosExit

SearchError:    Mov     BX, [PipeWriteHandle]           ; If error,
                Mov     DX, Offset DGROUP:Zeroes        ;   write zeroes to
                Mov     CX, 80                          ;   pipe
                Call    MyDosWrite

                Jmp     TerminateThread                 ;   and terminate

;-------------------------------------------------------------
; Find Them -- Recursive routine to find files fitting file spec
;-------------------------------------------------------------

FindThem:       Enter   4, 0            ; Dir Handle is   [BP - 2]
                                        ; Search Count is [BP - 4]

;-----------------------------------
; Get current directory for printing
;-----------------------------------

                Mov     [CurrDirLen], 64                ; Len for current dir
                Push    0                               ; Current disk drive
                Push    DS
                Push    offset DGROUP:CurrentDir        ; Space for current dir
                Push    DS
                Push    offset DGROUP:CurrDirLen
                Os2Call DosQCurDir                      ; Get current dir

                Mov     DX, Offset DGROUP:FullPathName  ; Find length of it
                Call    StringLen
                Cmp     AX, 3                           ; See if root
                Jz      NoMoreSlashes                   ; If so, skip next part

                Mov     SI, DS                          ; Add a slash
                Add     SI, AX                          ;   at end of directory
                Mov     Byte Ptr [SI], '\'
                Mov     Byte Ptr [SI + 1], 0
                Inc     AX

NoMoreSlashes:  Mov     [CurrDirLen], AX                ; Save total length

;----------------------
; Search for the files
;----------------------

                Mov     Word Ptr [BP - 2], -1   ; Initial directory handle
                Mov     Word Ptr [BP - 4], 1    ; Search for one file

                Push    [FileSpec + 2]          ; segment of find file name
                Push    [FileSpec]              ; offset of find file name
                Push    SS                      ; segment of directory handle
                Lea     AX, [BP - 2]            ; offset of directory handle
                Push    AX
                Push    07h                             ; attribute
                Push    DS                              ; segment of buffer
                Push    offset DGROUP:FileFindBuf       ; offset of buffer
                Push    FileFindBufLen                  ; length of buffer
                Push    DS                      ; segment of search count
                Lea     AX, [BP - 4]            ; offset of search count
                Push    AX
                Push    0                       ; Reserved
                Push    0
                Os2Call   DosFindFirst          ; Find first file

FindResult1:    Or      AX, AX                  ; See if error
                Jz      NoFindError1            ; If not skip next

                Cmp     AX, 18                  ; See if no more files
                Je      FindAllDone1            ; If so, done with search

                Jmp     SearchError             ; Process error

NoFindError1:   Cmp     Word Ptr [BP - 4], 0    ; See if zero files found
                Je      FindAllDone1            ; If so, done with search

                Mov     BX, [PipeWriteHandle]           ; Write drive and
                Mov     DX, Offset DGROUP:FullPathName  ;   directory path
                Mov     CX, [CurrDirLen]                ;   to pipe
                Mov     SI, CX
                Call    MyDosWrite

                Mov     DX, Offset DGROUP:FileFindBuf.file_name
                Mov     CL, [FileFindBuf.string_len]    ; Write file name
                Sub     CH, CH                          ;   to pipe
```

(Figure 1 continues)

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■ ENVIRONMENTS

USING FSB The syntax for FSB is

```
FSB filespec
```

FSB will find all matching filenames on the specified drive and directory and nested subdirectories of the specified directory. For example, simply to browse a file in the current directory, you might enter

```
FSB DOODAD.ASM
```

FSB will also search for DOODAD.ASM in nested subdirectories of the current directory. You'd use the command

```
FSB *.ASM
```

to browse all the .ASM files in the current directory (and nested subdirectories).

You can also use the command

```
FSB \directory\*.ASM
```

to browse all the .ASM files matching the filespec in the specified *directory* and its nested subdirectories. Or, by entering

```
FSB \*.ASM
```

you can find and browse through all the .ASM files on the entire disk.

FSB displays each matching file in a list. For each file, FSB will also save the current screen contents and then display the file in a full-screen mode for browsing. The high bit of each character is set to 0 (so FSB can be used on *WordStar* files). The Home, End, PgUp, PgDn, and arrow keys work as you would expect.

To browse through the next file, simply press the Spacebar. To terminate the program, just press Esc while the browse display is shown. As an alternative, you can terminate the program at any time by pressing Ctrl-Break or Ctrl-C.

To capture the file list to a file, use

```
FSB filespec >listfile
```

If you want to suppress the display of the file list, enter

```
FSB filespec >NUL
```

and to get a list of files that match the specification without browsing through them, use

```
DETACH FSB filespec >listfile
```

THE STRUCTURE OF FSB FSB.ASM is divided into three main sections. The first section is the entry point of the program (thread 1). This thread first parses the command line. If a drive or directory is specified, the thread switches to that drive or directory.

```
                Add     SI, CX
                Call    MyDosWrite

                Mov     DX, Offset DGROUP:Zeroes        ; Pad with zeroes
                Mov     CX, SS                          ;   written to pipe
                Sub     CX, SI
                Call    MyDosWrite

                Push    [BP - 2]                        ; Directory handle
                Push    DS                              ; segment of buffer
                Push    Offset DGROUP:FileFindBuf       ; offset of buffer
                Push    FileFindBufLen                  ; length of buffer
                Push    DS                              ; segment of count
                Lea     AX, [BP - 4]                    ; offset of count
                Push    AX
                Dos2Call DosFindNext                    ; Find next file

                Jmp     FindResult1                     ; Loop around

FindAllDone1:   Push    [BP - 2]                        ; directory handle
                Dos2Call DosFindClose                   ; close it

;-------------------------
; Now search for subdirectories
;-------------------------

                Mov     Word Ptr [BP - 2], -1   ; Initial directory handle
                Mov     Word Ptr [BP - 4], 1    ; Search for one directory

                Push    DS                              ; segment of spec
                Push    Offset DGROUP:StarDotStar       ; offset of spec
                Push    SS                              ; segment of handle

                Lea     AX, [BP - 2]                    ; offset of handle
                Push    AX
                Push    16h                             ; attribute (dirs only)
                Push    DS                              ; segment of buffer
                Push    Offset DGROUP:FileFindBuf       ; offset of buffer
                Push    FileFindBufLen                  ; length of buffer
                Push    DS                              ; segment of count
                Lea     AX, [BP - 4]                    ; offset of count
                Push    AX
                Push    0                               ; reserved
                Push    0
                Dos2Call DosFindFirst                   ; Find first dir

FindResult2:    Or      AX, AX                  ; Check if error
                Jz      NoFindError2

                Cmp     AX, 18                  ; Check if all finished
                Jz      FindAllDone2

                Jmp     SearchError

NoFindError2:   Cmp     Word Ptr [BP - 4], 0    ; Check if no dirs found
                Jz      FindAllDone2

                Test    [FileFindBuf.attributes], 10h   ; See if directory
                Jz      FindTheNext

                Cmp     [FileFindBuf.file_name], '.'    ; Exclude '.' and '..'
                Jz      FindTheNext

                Push    DS                      ; Change the directory
                Push    Offset DGROUP:FileFindBuf.file_name
                Push    0
                Push    0
                Dos2Call DosChdir

                Call    FindThem                ; Recursive call

                Push    DS                      ; Change to '..' directory
                Push    Offset DGROUP:BackDir
                Push    0
                Push    0
                Dos2Call DosChdir

FindTheNext:    Push    [BP - 2]                        ; search handle
                Push    DS                              ; segment of buffer
                Push    Offset DGROUP:FileFindBuf       ; offset of buffer
                Push    FileFindBufLen                  ; length of buffer
                Push    DS                              ; segment of count
                Lea     AX, [BP - 4]                    ; offset of count
                Push    AX
                Dos2Call DosFindNext                    ; Find next directory

                Jmp     FindResult2

FindAllDone2:   Push    [BP - 2]                ; directory handle
                Dos2Call DosFindClose           ; close it

                Leave
                Ret

_TEXT           ENDS

;-------------------------------------------------------------------------
;-------------------------------------------------------------------------
; BROWSE section to display files after names are read from pipe
;-------------------------------------------------------------------------
;-------------------------------------------------------------------------

;-------------------------------------
; Initialized Data Segment for Browse
;-------------------------------------

_DATA           SEGMENT

                db      'ATTR1='
Attribute1      db      16h             ; Attribute for file text
                db      'ATTR2='
Attribute2      db      4Fh             ; Attribute for file name
                db      'SHIFT='
ShiftHoriz      db      0               ; Horizontal shift screen default

FileOffset      dw      -1, -1
Dispatch        dw      Home,  Up,    PgUp,  Dummy,  Left
                dw      Dummy, Right, Dummy, EndKey, Down, PgDn

_DATA           ENDS

;---------------------------------------
; Uninitialized Data Segment for Browse
;---------------------------------------

_BSS            SEGMENT

ModeData        ModeDataStruc <>
KeyData         KeyDataAStruc <>

Buffer          db      16384 dup (?)
BufferMid       db      16384 dup (?)
BufferEnd       Label   Byte

ScreenSize      dw      ?
ScreenStart     dw      ?
EndOfFile       dw      ?
HorizOffset     dw      ?
RightMargin     dw      ?

ScreenAddr      Label   DWord
ScreenOff       dw      ?
ScreenSeg       dw      ?

FileHandle      dw      ?
OpenAction      dw      ?
```

(Figure 1 continues)

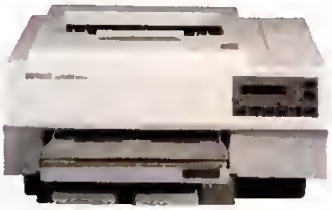
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■ ENVIRONMENTS

```
NewPointer      dd      ?
ScreenSaveSel   dw      ?

_BSS            ENDS

;--------------------------
; Code Segment for Browse
;--------------------------

_TEXT           SEGMENT

;---------------------------
; Open the File for reading
;---------------------------

Browse:         Mov     [FileOffset], -1        ; Initialize these pointers
                Mov     [FileOffset + 2], -1

                Push    DS                      ; segment of name
                Push    Offset DGROUP:FullFileName      ; offset of name
                Push    DS                      ; segment for handle
                Push    Offset FileHandle       ; offset for handle
                Push    DS                      ; segment for 'action'
                Push    Offset OpenAction       ; offset for 'action'
                Sub     AX, AX
                Push    AX                      ; high size (ignored)
                Push    AX                      ; low size (ignored)
                Push    AX                      ; attribute (ignored)
                Push    1                       ; open if file exists
                Push    0A0h                    ; read only / deny write
                Push    AX                      ; reserved
                Push    AX                      ; reserved

                OS2Call DosOpen                 ; Open File

                Or      AX, AX                  ; Check if error
                Ja      OutTheFile              ; If not, continue

                Mov     AX, Offset DGROUP:FileOpenError
                Ret
GotTheFile:

;-----------------------------
; Get Screen Mode Information
;-----------------------------

                Mov     [ModeData.md_length], 12        ; length of structure

                Push    DS                      ; segment of structure
                Push    Offset ModeData         ; offset of structure
                Push    0                       ; reserved
                OS2Call VioGetMode              ; get video mode

                Or      AX, AX                  ; See if error (only if
                Ja      NotDetached             ;   program is detached)

VideoError:     Mov     AX, Offset DGROUP:VideoModeError
                Ret

NotDetached:    Test    [ModeData.md_type], 2   ; See if graphics mode
                Jne     VideoError              ; If so, do not continue

                Mov     AX, [ModeData.col]      ; character columns
                Mul     [ModeData.row]          ; character rows
                Jc      VideoError              ; Leave if exceeds 64k

                Add     AX, AX                  ; Fitto here
                Jc      VideoError

                Mov     [ScreenSize], AX        ; Save screen size in bytes

                Push    DS                      ; segment for address
                Push    Offset ScreenAddr       ; Offset for address
                Push    DS                      ; Segment for size
                Push    Offset ScreenSize       ; Offset for size
                Push    0                       ; Reserved
                DS2Call VioGetBuf               ; Get logical video buffer

                Or      AX, AX                  ; Leave if an error
                Jne     VideoError

;--------------------------------------
; Allocate memory and save screen in it
;--------------------------------------

                Push    [ScreenSize]            ; Size of segment
                Push    DS                      ; Segment for selector
                Push    Offset ScreenSaveSel    ; Offset for selector
                Push    E                       ; No sharing
                OS2Call DosAllocSeg             ; Allocate segment

                Or      AX, AX                  ; If error, leave
                Jne     VideoError

                Push    [ScreenSaveSel]         ; Segment for destination
                Sub     AX, AX
                Push    AX                      ; Offset for destination
                Push    DS                      ; Segment of screen size
                Push    Offset ScreenSize       ; Offset of screen size
                Push    AX                      ; Starting row
                Push    AX                      ; Starting column
                Push    AX                      ; Reserved
                OS2Call VioReadCellStr          ; Save the screen

                Call    SetExitList             ; Will restore on exit

;---------------------------------------
; Get keyboard key and decide on action
;---------------------------------------

                Call    Home                    ; Read file in
                Mov     [ScreenStart],BI        ; Set buffer address

KeyLoop:        Push    ThreadID                ; Don't let the search
                OS2Call DosSuspendThread        ;    slow down the update

                Call    UpDateScreen            ; Update the screen

                Push    ThreadID
                OS2Call DosResumeThread         ; Let the search resume

GetKey:         Push    DS                      ; Segment of structure
                Push    Offset KeyData          ; Offset of structure
                Push    0                       ; Wait for key
                Push    0                       ; Reserved
                OS2Call KbdCharIn               ; Read key

                Mov     AL, [KeyData.char_code] ; Get character code

                Cmp     AL, ' '                 ; A space means do next
                Ja      SpaceLeave              ;   file

                Cmp     AL,27                   ; Check if ESC
                Je      EscLeave                ; If so, terminate

                Cmp     AL, 0E0h                ; E0 for enhanced keyboard
                Je      ScanCode                ;   extended keys

                Or      AL, AL                  ; Check if extended
                Jne     GetKey                  ; If not, try again

ScanCode:       Mov     AL, [KeyData.scan_code] ; Get scan code

                Sub     AL,71                   ; Subtract Home key value
                Jb      GetKey                  ; If below that, not valid
                Cmp     AL,(81 - 71)            ; Check if above PgDn
                Ja      GetKey                  ; If so, ignore it
                Sub     AH,AH                   ; Zero out top byte
                Add     AX,AX                   ; Double for word access
                Mov     BX,AX                   ; Offset in dispatch table
                Mov     BI,[ScreenStart]        ; Get current buffer pointer
                Call    [Dispatch + BX]         ; DO the call
                Mov     [ScreenStart],BI        ; Get new buffer pointer
                Jmp     KeyLoop                 ; And update the screen

;-----------------------------------------
; Terminate -- Restore screen and close file
;-----------------------------------------

SpaceLeave:     Call    ExitRoutine             ; Restore screen
                Call    UnsetExitList           ; Take away exit list
                Sub     AX, AX                  ; 0 means continue with files
                Ret                             ; Return

EscLeave:       Call    ExitRoutine             ; Restore screen
                Call    UnsetExitList           ; Take away exit list
                Mov     AX, -1                  ; -1 means stop program
                Ret                             ; Return

;--------------------------------------
; Exit List Processing for Ctrl-Break
;--------------------------------------

SetExitList:    Push    1                       ; Set on exit list
                Push    CS                      ; Segment of routine
                Push    Offset ExitList         ; Offset of routine
                DS2Call DosExitList
                Ret

UnsetExitList:  Push    2                       ; Unset an exit list
                Push    CS                      ; Segment of routine
                Push    Offset ExitList         ; Offset of routine
                OS2Call DosExitList
                Ret

ExitRoutine:    Push    [ScreenSaveSel]         ; Segment of saved screen
                Push    0                       ; Offset of saved screen
                Push    [ScreenSize]            ; Length of saved screen
                Push    0                       ; Starting row
                Push    0                       ; Starting column
                Push    0                       ; Reserved
                OS2Call VioWrtCellStr           ; Restore screen

                Push    [FileHandle]            ; File handle
                OS2Call DosClose                ; Close it
                Ret

ExitList:       Call    ExitRoutine             ; Do exit routine
                Push    3                       ; Then continue exiting
                Push    0
                Push    0
                OS2Call DosExitList

;---------------------------------
; Cursor Key Routines -- Home Key
;---------------------------------

Home:           Sub     BX,BX                   ; For zeroing out values
                Mov     AX,[FileOffset]         ; Check if read in file
                Or      AX,[FileOffset + 2]
                Mov     [FileOffset],BX         ; Zero out file address
                Mov     [FileOffset + 2],BX
                Mov     [HorizOffset],BX        ; Zero out horizontal offset
                Mov     BI,Offset Buffer        ; Reset buffer pointer
                Ja      Dummy                   ; Skip file read if in already
                Mov     DX,Offset Buffer        ; Area to read file in
                Mov     CX,32768                ; Number of bytes to read
                Call    FileRead                ; Read in file
Dummy:          Ret

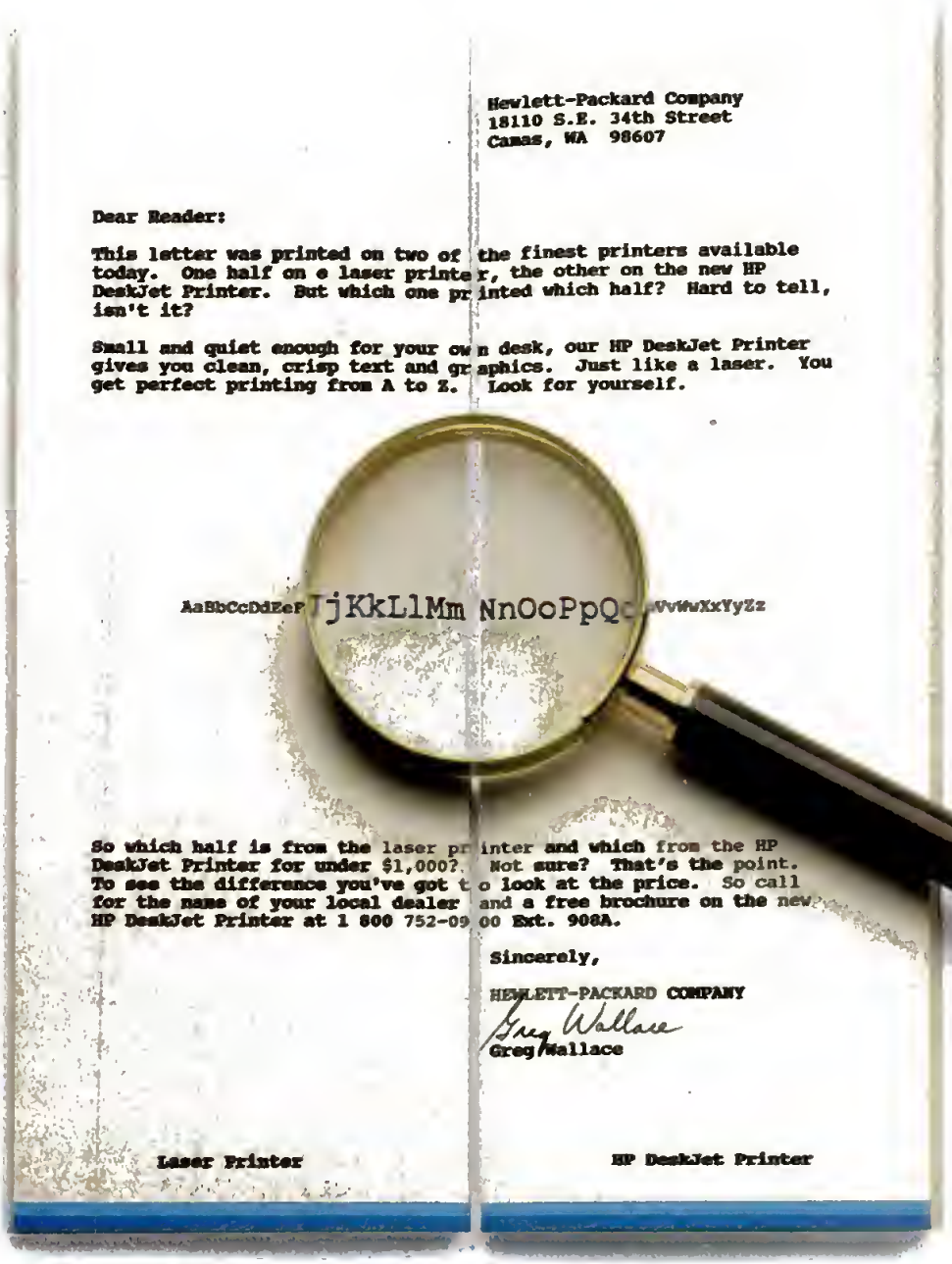
;------------------
; Up and PgUp Keys
;------------------

Up:             Call    GetPrevChar             ; Get previous char in buffer
                Jc      UpDone                  ; If none available, finish
UpLoop:         Call    DBCPrevChar             ; Get previous char again
                Jc      UpDone                  ; If none, we're done
                Cmp     AL,10                   ; Check if line feed
                Jne     UpLoop                  ; If not, try again
                Call    GetNextChar             ; Get char after line feed
UpDone:         Ret

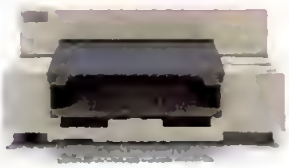
PgUp:           Mov     CX,Word Ptr [ModeData.row]      ; Number of lines
                Dec     CX                              ;   less title line
```

(Figure 1 continues)

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```
PgUpLoop:       Call    Up                      ; Do UP that many times
                Loop    PgUpLoop
                Ret

;---------------------
; Left and Right Keys
;---------------------

Left:           Mov     [HorizOffset],0         ; Reset Horizontal Offset
                Ret

Right:          Mov     AL,[ShiftHoriz]         ; Get places to shift
                Sub     AH,AH
                Add     [HorizOffset],AX        ; Move that many right
                Ret

;----------------------------
; EndKey, Down, and PgDn Keys
;----------------------------

EndKey:         Mov     AX,SI                   ; Save buffer pointer
                Call    PgDn                    ; Go page down
                Cmp     SI,SI                   ; Check if we did No
                Jnz     EndKey                  ; If No, do it again
                Ret

Down:           Call    GetNextChar             ; Get next character
                Jc      NoMoreDown              ; If no more, we're done
DownLoop:       Call    GetNextChar             ; Get one again
                Jc      UpLoop                  ; If no more, find prev LF
                Cmp     AL,10                   ; See if line feed
                Jnz     DownLoop                ; If not, continue
NoMoreDown:     Ret

PgDn:           Mov     CX,Word Ptr [ModeData.row]      ; Number of lines
                Dec     CX                              ;   less title line

PgDnLoop:       Call    Down                    ; Do DOWN that many times
                Loop    PgDnLoop
                Ret

;---------------
; Update Screen
;---------------

UpdateScreen:   Push    ES

                Les     DI,[ScreenAddr]         ; Address of display
                Mov     CX,ScreenSize           ; Number of bytes in screen
                Shr     CX,1                    ; Half for number of chars
                Mov     AL,' '                  ; Will blank screen
                Mov     AH,[Attribute1]         ; With screen attribute
                Rep     Stosw                   ; Blank it

                Mov     CX, [ModeData.col]      ; Number of character cols
                Mov     DI, [ScreenOff]         ; Offset of screen
                Mov     SI, Offset DGROUP:FullFileName  ; File name

DisplayName:    Lodsb                           ; Get character
                Or      AL, AL                  ; See if end
                Jz      EndOfName
                Mov     AH, [Attribute2]        ; Use second attribute
                Stosw                           ; Display it
                Loop    DisplayName

EndOfName:      Mov     SI,[ScreenStart]        ; Address of data in buffer
                Mov     DL, 1                   ; Start with second line

                Mov     AL, Byte Ptr [ModeData.col]     ; Length of row
                Sub     AH,AH
                add     AX,[HorizOffset]        ; Add Horizontal Offset
                Mov     [RightMargin],AX        ; That's right display margin

LineLoop:       Sub     AX,AX                   ; Column Number
                Mov     AL, Byte Ptr [ModeData.col]     ; Use Line length
                Mul     DL                      ;   and Line Number
                Add     AX,AX                   ;     to recalculate
                Mov     DI,AX                   ;       display destination
                Add     DI,[ScreenOff]          ; Add beginning address

CharLoop:       Call    GetNextChar             ; Get next character
                Jc      EndOfScreen             ; If No more, we're done

                Cmp     AL,13                   ; Check for carriage return
                Je      CharLoop                ; Do nothing if so
                Cmp     AL,10                   ; Check for line feed
                Je      LineFeed                ; Do routine if so
                Cmp     AL,9                    ; Check for tab
                Je      Tab                     ; Go routine if so
                Mov     CX,1                    ; Just 1 char to display

PrintChar:      Cmp     AX,[HorizOffset]        ; See if we can print it
                Jb      NoPrint
                Cmp     AX,[RightMargin]        ; See if within margin
                Jae     NoPrint
                Mov     AH,[Attribute1]         ; Attribute for display

WriteIt:        Stosw                           ; Write without retrace wait
NoPrint:        Inc     AX                      ; Bump up Column counter
                Loop    PrintChar               ; Do it CX times

                Jmp     CharLoop                ; Then go back to top

Tab:            Mov     AX,AX                   ; Current Column Number
                And     AX,07h                  ; Take lower three bits
                Mov     CX,8
                Sub     CX,AX                   ; Subtract from 8
                Mov     AL,' '                  ; Will print CX blanks
                Jmp     PrintChar

LineFeed:       Inc     DL                      ; Next line
                Cmp     DL,Byte Ptr [ModeData.row]      ; See if down at bottom
                Jb      LineLoop                ; If not, continue

EndOfScreen:    Push    0                       ; Offset of buffer
                Push    [ScreenSize]            ; Size of buffer
                Push    0                       ; Reserved
                OS2Call VioShowBuf              ; Update the screen

                Pop     ES                      ; All done -- leave
                Ret

;---------------------------------
; Get Next Character from buffer
;---------------------------------
;               (Input is SI pointing to buffer, Returns AL, CY if no more)

GetNextChar:    Cmp     SI, [EndOfFile]         ; See if at end of file
                Jae     NoMoreNext              ; If so, no more chars
                Cmp     SI, OFFset BufferEnd    ; See if at end of buffer
                Jb      CanGetNext              ; If not, just get character

                Push    CX                      ; Otherwise save registers
                Push    DX
                Push    DI
                Push    ES
                Push    DS                      ; Set ES to DS
                Pop     ES                      ;   (could be different)

                Mov     SI,Offset BufferMid     ; Move 2nd buffer half
                Mov     DI,Offset Buffer        ;   to 1st buffer half
                Mov     CX,16384
                Sub     [ScreenStart],CX        ; New buffer pointer
                Rep     Movsb                   ; Move them
                Mov     SI,DI                   ; SI also buffer pointer
                Add     [FileOffset],32768      ; Adjust file addr to read
                Adc     [FileOffset + 2],0
                Mov     DX,Offset BufferMid     ; Place to read file
                Mov     CX,16384                ; Number of bytes
                Call    FileRead                ; Read the file
                Sub     [FileOffset],16384      ; Now adjust to reflect
                Sbb     [FileOffset + 2],0      ;   1st half of buffer

                Pop     ES                      ; Get back registers
                Pop     DI
                Pop     DX
                Pop     CX

                Jmp     GetNextChar             ; And try again to get char
CanGetNext:     Lodsb                           ; Get the character
                And     AL, 7Fh
                Stc
NoMoreNext:     Cmc                             ; So CY set if no more
                Ret
;-------------------------------------
; Get Previous Character from buffer
;-------------------------------------

GetPrevChar:    Cmp     SI,Offset Buffer        ; See if at top of buffer
                Ja      CanGetPrev              ; If not, just get character
                Mov     AX,[FileOffset]         ; See if at top of file
                Or      AX,[FileOffset + 2]
                Jz      AtTopAlready            ; If No, can't get anymore

                Push    CX                      ; Save some registers
                Push    DX
                Push    ES
                Push    DS
                Pop     ES

                Mov     SI,Offset Buffer        ; Move 1st half of buffer
                Mov     DI,Offset BufferMid     ;   to 2nd half of buffer
                Mov     CX, 16384
                Add     [ScreenStart], CX       ; New buffer pointer
                Rep     Movsb                   ; Do the move
                Sub     [FileOffset], 16384     ; Adjust file addr for read
                Sbb     [FileOffset + 2], 0
                Mov     DX, Offset Buffer       ; Area to read file into
                Mov     CX, 16384               ; Number of bytes
                Call    FileRead                ; Read the file

                Pop     ES
                Pop     DX                      ; Get back registers
                Pop     CX

CanGetPrev:     Dec     SI                      ; Move pointer back
                Mov     AL,[SI]                 ; Get the character
                And     AL, 7Fh                 ; Wipe out high byte
                Stc                             ; CY flag reset for success

AtTopAlready:   Cmc                             ; CY flag set for no more
                Ret

;-----------------------------------------
; Read CY bytes from the file into DX buffer
;-----------------------------------------

FileRead:       Push    AX                      ; Save some registers
                Push    AX
                Mov     [EndOfFile], -1         ; Initialize this

                Push    [FileHandle]            ; File handle
                Push    [FileOffset + 2]        ; New pointer (high)
                Push    [FileOffset]            ; New pointer (low)
                Push    0                       ; Action
                Push    DS                      ; Segment for new pointer
                Push    Offset NewPointer       ; Offset for new pointer
                OS2Call DosChgFilePtr

                Mov     BX, [FileHandle]        ; Read from the file
                Call    MyDosRead

                Or      AX, AX                  ; See if error
                Mov     AX, [BytesRead]
                Js      NoReadError             ; If so error, continue

                Sub     AX, AX                  ; Otherwise read zero bytes
NoReadError:    Cmp     AX,CX                   ; See if DX bus been read
                Je      GotItAll                ; If so, we're home free

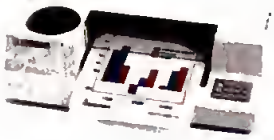
                Add     AX,DX                   ; Otherwise Add in buffer addr
                Mov     [EndOfFile],AX          ; And save as end of file

GotItAll:       Pop     AX
                Pop     AX
                Ret

_TEXT           ENDS
                END     Entry
```

(Figure 1 ends)

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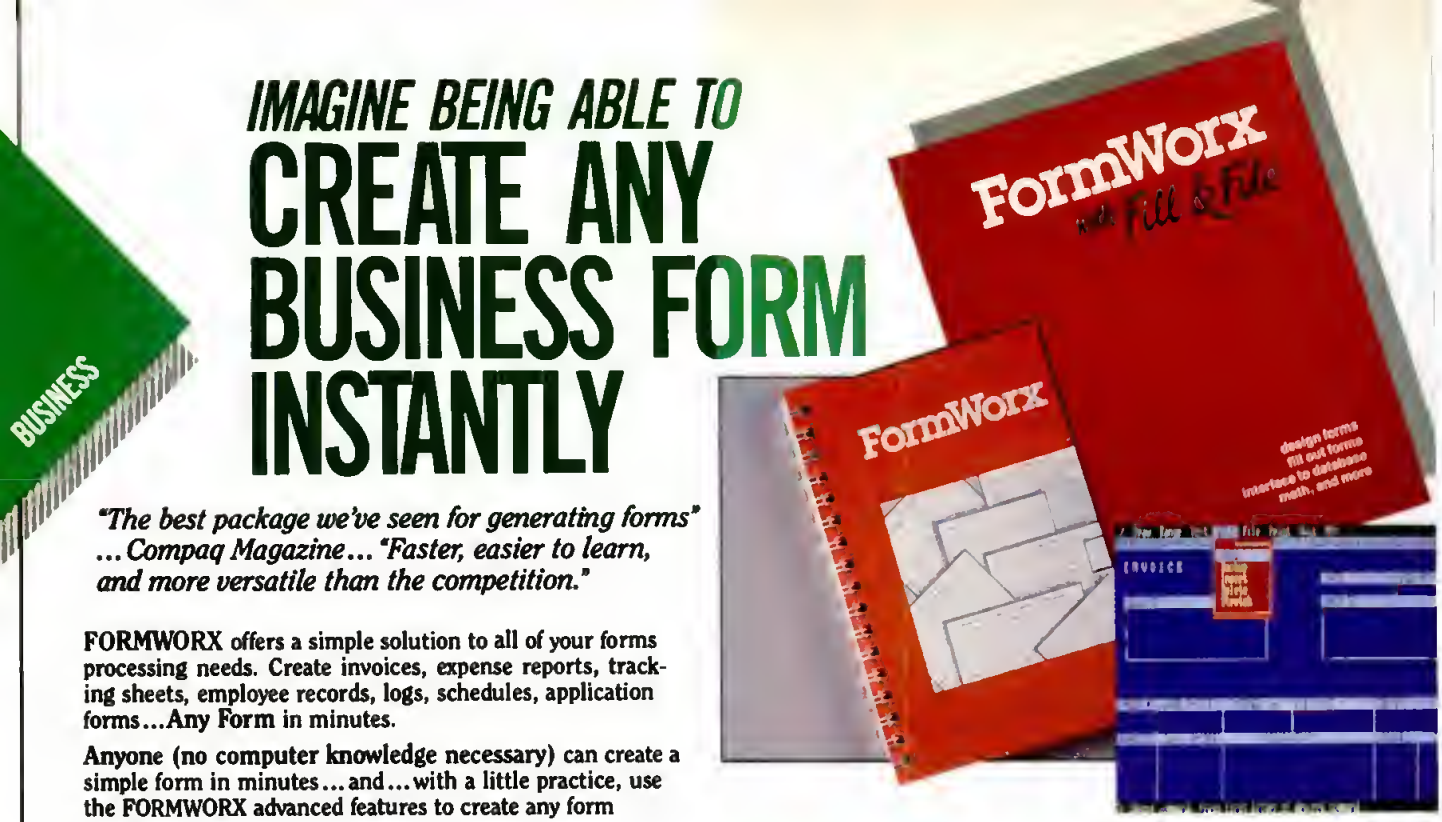
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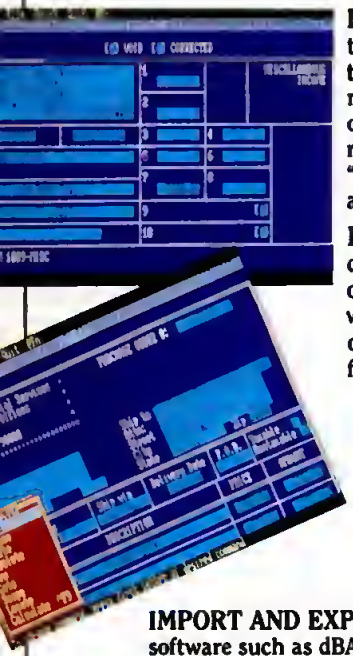


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The first thread then creates a pipe (described below) and starts up a second thread of execution. The second thread finds files matching the file specification and writes the filenames into the pipe. The first thread reads the filenames from the pipe, displays them to standard output, and then calls the Browse function.

The Browse function runs under the first thread. Under DOS, such a routine would write directly to the display. OS/2 provides instead a "logical video buffer" that a program can obtain by calling VioGetBuf. The program then writes to this block of memory just as if it were writing to the video display under DOS. When the program wants to update the video display, it calls VioShowBuf. Before displaying the file, the Browse function saves the current contents of the display using VioReadCellStr and later restores the display using VioWriteCellStr.

Because the second thread does the file find, it continues to run while you're browsing a file. When you first use FSB, this may seem a little strange—when the browse screen pops up, you don't expect

```
100 REM - BASIC PROGRAM TO CREATE FSB.EXE
110 CLS:PRINT "Creating FSB.EXE": OPEN "FSB.EXE" AS #1 LEN = 1
120 FIELD #1,1 AS A$: CHECKSUM&=0
130 FOR I = 1 TO 159: LIBESUM&=0: LOCATE 2,3: PRINT "Countdown: " 159 - I;
140  FOR J = 1 TO 16 : READ BYTE$: CHECKSUM&=CHECKSUM&+VAL("&H"+BYTE$)
150   LIBESUM&=LIBESUM&+VAL("&B"+BYTE$)
160   IF (BYTE < 256) THEN LSET A$=CHR$(VAL("&B"+BYTE$))
170   PUT #1: NEXT J
180  READ LINETOT$: LINECHECK$ = VAL("&B" + LINETOT$)
190  IF LINECHECK$ = LIBESUM& THEN GOTO 210
200  LOCATE 4,2: PRINT "Error in line 8";240 + 10  * 2
210 NEXT 2: CLOSE: LOCATE 6,2
220 IF CHECKSUM& <> 223179 THEN GOTO 240
230 PRINT "FSB.EXE created successfully": SYSTEM
240 PRINT "FSB.EXE is not valid!": SYSTEM
256    DATA 4D, 5A, B4,  1,  5,  0,  0,  0,  4,  0,  0,  0, FF, FF,  0,  0, 393
26F    DATA B8,  0,  0,  0,  0,  0,  0,  0, 40,  0,  0,  0,  0,  0,  0,  0, F8
288    DATA  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0
2A1    DATA  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0, B8,  0,  0,  0, 88
2BA    DATA  E, 1F, BA,  E,  0, B4,  9, CD, 21, B8,  1, 4C, CD, 21, 54, 68, 54F
2D0    DATA 69, 73, 20, 70, 72, 6F, 67, 72, 61, 6D, 20, 63, 61, 6E, 6F, 74, 423
2E6    DATA 74, 20, 62, 65, 20, 72, 75, 6E, 20, 69, 6E, 20, 44, 4F, 53, 20, 4BD
2FC    DATA 6D, 6F, 64, 65, 2E,  D,  A, 24,  0,  0,  0,  0,  0,  0,  0,  0, 28B
312    DATA 4E, 45,  5,  1, C8,  0,  2,  0, B7, B1, B4, 96,  2,  0,  2,  0, 411
328    DATA  0,  0,  0,  0,  0,  0,  1,  0, D6, 92,  2,  0,  2,  0,  3,  0, 16A
33E    DATA  E,  0, 40,  0, 58,  0, 58,  0, 57,  0, 5D,  0, 42,  1,  0,  0, 1E2
354    DATA  0,  0,  4,  0,  0,  0,  1,  0,  0,  0,  0,  0,  0,  0,  0,  0,  5
36A    DATA 15,  0, 3C,  0,  0,  D, 3C,  0, 66,  0, 84,  1,  1,  C, D0, 92, 328
380    DATA  3, 46, 53, 42,  0,  0,  0,  1,  0,  A,  0, 1D,  0,  0,  0, 44, 152
396    DATA 4F, 53, 43, 41, 6C, 4C, 53,  0, 4B, 42, 44, 43, 41, 6C, 4C, 53, 459
3AC    DATA  9, 4B, 42, 44, 43, 4B, 41, 52, 49, 4B,  8, 56, 46, 4F, 45, 41, 489
3C2    DATA 4C, 4C, 53,  6, 56, 49, 4F, 47, 45, 54, 42, 45, 46,  A, 56, 49, 448
3D8    DATA 4F, 47, 45, 54, 4D, 4F, 44, 45,  B, 56, 49, 4F, 52, 45, 41, 44, 46C
3EE    DATA 43, 45, 4C, 4C, 51, 54, 52,  A, 56, 49, 4F, 53, 4B, 4F, 57, 42, 494
404    DATA 55, 46,  D, 56, 49, 4F, 57, 52, 54, 43, 45, 4C, 4C, 53, 54, 52, 4AC
41A    DATA  0,  0,  7, 46, 53, 42, 2B, 45, 58, 45,  0,  0,  0,  0,  0,  0, 1F2
430    DATA 1E,  7, 8B, D8, 8B, F3, AC,  A, C8, 75, FB, AC,  A, C8, 75,  3, 7DD
446    DATA B6, 97,  0, B9,  5,  0, BF, 47,  1, F2, AE, 74, 4E, 8B, 3C, 3A, 73D
45C    DATA 75, 16, 24, DF, 2C, 48, 2A, E4, 58, 9A, FF, FF,  0,  0, BA, 7A, 724
472    DATA  0,  B, C8, 75, 78, 83, C6,  2, 4B, 26, 89, 36, 84,  1, 26, 8C, 56D
488    DATA 1E, 86,  1, AC, 3C, 5C, 75,  5, 26, 89, 36, 98,  1, B9,  6,  0, 498
49E    DATA BF, 47,  1, F2, AB, 75, EC, C6, 44, FF,  0, 26, 8B, 16, 88,  1, 781
4B4    DATA  E, F6, 74, 38, 4B, 26, 3E, 36, 84,  1, 75,  D, 26, FF,  6, 84, 548
4CA    DATA  1, 68, FF, FF, 68, 45,  1, EB, 13, C6,  4,  0, 26, FF, 36, 86, 68E
4E0    DATA  1, 26, FF, 36, 84,  1, 46, 26, 89, 36, 94,  1, 6A,  0, 6A,  0, 465
4F6    DATA 9A, FF, FF,  0,  0, BA, 92,  0,  E, C8, 75, 11,  6, 1F, B8, 25, 667
50C    DATA  0, 6A,  1, 6A,  0, 9A, FF, FF,  0,  0, BA,  0,  0, E8, 72,  0, 551
522    DATA 8B, D8, 8B,  2,  0, 8B, C5,  0, 8B, C8, 8B, D2,  0, 6A,  1, 6A, 792
538    DATA  1, 9A, A6,  0,  0,  0, 1E, 68, 0A,  1, 1B, 68, 6C,  1, 68,  0, 3CD
54E    DATA 48, 6A, FF, FF,  0,  0, BA, C8,  0,  E, C8, 75, D0,  E, 68, 64, 76C
564    DATA  1, 1B, 68, 0B,  1, 1E, 68, 98,  6, 9A, FF, FF,  0,  0, BA, DC, 663
57A    DATA  0,  B, C8, 75, B8, B6, 50,  0, BA, 98,  6, 8B, 1E, 6A,  1, B8, 678
590    DATA 5F,  0, 83, 3B, 8D,  6,  0, 74, 57,  3, 16, B8,  6, 2E,  D, B8, 4BF
5A6    DATA  9, 75, E0, BA, A6,  0, B8, 3B, 68,  6,  0, 74, 68, EB,  1,  0, 5E0
5BC    DATA BA, 68,  6, B0, 57,  0, 8B, C0, B8, 44,  0, B9,  2,  0, BA, 77, 6FD
5D2    DATA  0, B8, 3B,  0, B8, 3B, 4D,  1,  1, 75, BA, B8, D3,  1,  B, C0, 5E6
5E8    DATA 74, B3, 3D, FF, FF, 74, 16, 3E, 26,  1, 75,  5, C6,  6, 4D,  1, 5B7
5FE    DATA  0, EB,  2,  0, 8B, D8, E8, 24,  0, 8E, C8, B0, 11,  0, BB, 65, 6F0
614    DATA C3, 53, 1B, 52, 51, 1B, 68, B0,  6, 9A, FF, FF,  0,  0, C3, 53, 6F4
62A    DATA 1B, 52, 51, 1B, 68, E2,  9, 9A, FF, FF,  0,  0, C3,  6, 57, 51, 63B
640    DATA 1E,  7, 8B, FA, E9, FF, FF, 2A, C8, F2, AE, F7, D1, 46, 0B, C1, A48
656    DATA 59, 5F,  7, C3, 1B, 68,  0,  A, 1B, 68, 6D,  A, 9A, FF, FF,  0, 5DF
66C    DATA  0, 80,  6,  0,  A, 40, C6,  6,  A, 3A, C6,  6,  A,  A, 5C, 32D
682    DATA E0, 21,  0, FF, 36, 8C,  1, 6A, FF, FF,  0,  0, 6A,  0, 6A,  0, 637
698    DATA 9A, C2,  E,  0,  0, 8E, 1E, 8C,  1, BA, 4D,  A, 09, 50,  0, E0, 564
6AE    DATA 6E, FF, ED, DF, C0,  4,  0,  0, C7,  6, 4E,  A, 48,  0, 8A,  0, 5FE
6C4    DATA 1E, 68,  E,  A, 1E, 68, 4D,  A, 9A, FF, FF,  0,  E, BA,  0,  A, 4DA
6DA    DATA E0, BA, FF, 3D,  3,  0, 74,  C, 8B, F2,  3, FE, C8,  4, 5C, C8, 78D
6F0    DATA 44,  1,  0, 48, A3, 4E,  A, C7, 46, FE, FF, C7, 46, FC,  1, 79B
706    DATA  8, FF, 36, 86,  1, FF, 36, 84,  1, 16, 8D, 46, FE, 50, 6A,  7, 61B
71C    DATA 1E, 6D, E4,  9, 8A, 24, 1E, 8D, 46, FC, 50, 6A,  E, 8A,  0, 9A, 5AC
732    DATA FF, FF,  0,  0,  B, C8, 74,  7, 3D, 12,  0, 74, 46, EB, 06, 03, 641
748    DATA 7E, FC,  8, 74, 3B, 8B, 1E, 6C,  1, BA,  8,  A, 8B,  B, 4B,  A, 51C
75E    DATA 80, F1, E0, 1A, FF, BA, FE,  9, 8A,  E, FA,  6, 2A, ED,  3, F1, 8E1
774    DATA E8,  C, FF, BA, 4E,  A, E6, 50,  0, 2E, CE, E8,  1, FF, FF, 76, 863
78A    DATA FE, 1E, 6D, E4,  6, 6A, 24, 1E, 8D, 46, FC, 50, 9A, FF, FF,  0, 7D4
7A0    DATA  0, EB, E1, FF, 76, FE, 6A, FF, FF,  0,  0, C7, 46, FE, FF, FF, AE8
7B6    DATA C7, 46, FC,  1,  0, 1B, 68, 51,  1, 16, 8D, 46, FE, 50, 6A, 10, 593
7CC    DATA 1E, 6D, E4,  6, 8A, 24, 1E, 8D, 46, FC, 50, 6A,  0, 8A,  0, 6A, 5AC
7E2    DATA 30,  2,  0,  0,  E, C8, 74,  0, 3D, 12,  0, 74, 4A, E6,  5, FF, 473
7F8    DATA 03, 7E, FC,  8, 74, 41, F7,  6, FE,  6, 10,  8, 74, 24, 00, 3E, 616
80E    DATA FE,  6, 2B, 74, 1D, 1B, 68, FE,  6, BA,  E, 6A,  8, 9A, 61,  0, 54C
824    DATA  0,  0, E0, EF, FE, 1E, 68, 6E,  1, 6A,  0, 6A,  0, 9A, DE,  2, 5F0
83A    DATA  0,  0, FF, 76, FE, 1E, 6D, E4,  0, 8A, 24, 1E, 8D, 46, FC, 50, 6E1
850    DATA 9A, 7E,  2,  0,  0, EB, AD, FF, 70, FE, 6A, 07,  2,  0,  0, C9, 710
866    DATA C3, C7,  6, 6A,  1, FF, FF, C7,  6, 6C,  1, FF, FF, 1B, 68, 68, 847
87C    DATA  6, 1E, 68, C5, 8A, 1E, 68, C7, 8A, 2E, C8, 58, 58, 58, 8A,  1, 5FE
892    DATA 68, A8,  8, 58, 56, 9A, FF, FF,  8,  8,  B, C8, 74,  4, B8,  1, 63C
8A8    DATA  1, C3, C7,  6, A1,  A,  C,  8, 1E, 68, A1,  A, 8A,  8, 9A, FF, 57C
8BE    DATA FF,  8,  8,  B, C8, 74,  4, E8, 26,  1, C2, F6,  6, A3,  A,  2, 58F
8D4    DATA 75, F5, A1, A5,  A, F7, 26, A7,  A, 72, EC,  3, C8, 72, E8, A3, 8A6
8EA    DATA B7, 8A, 1B, 68, C1, 8A, 1B, 68, B7, 8A, 6A,  8, 9A, FF, FF,  8, 7DB
900    DATA  8,  B, C8, 75, D2, FF, 36, B7, 8A, 1E, 68, CD, 8A, 6A,  8, 9A, 766
916    DATA FF, FF,  8,  8,  B, C8, 75, 0F, FF, 36, CD, 8A, 2B, C8, 58, 1E, 7E2
92C    DATA 68, B7, 8A, 58, 59, 58, 9A, FF, FF,  8,  8, B8, 6B,  8, B8, B8, 81F
942    DATA  8, B9, 36, B9, 8A, FF, 36, 8B,  1, 9A, FF, FF,  8,  8, B8, 16, 75C
958    DATA  1, FF, 36, 8B,  1, 9A, FF, FF,  8,  8, 1B, 68, AD,  A, 6A,  8, 684
96E    DATA 6A,  8, 9A, FF, FF,  8,  8, A8, AD,  A, 3C, 20, 74, 2B, 3C, 1B, 5AB
984    DATA 74, 38, 3C, B8, 74,  4,  A, C8, 75, B9, A8, AE,  A, 2C, 47, 72, 694
99A    DATA D9, 3C,  A, 77, D5, 2A, B6,  3, C8, 8B, D8, 8B, 36, B9, 8A, FF, 8A2
9B0    DATA 97, 6E,  1, B9, 36, B9, 8A, EB, AC, B8, 2B,  8, E8, 19,  8, 2B, 6DB
9C6    DATA C8, C3, B8, 1F,  8, B8, 10,  8, B8, FF, FF, C3, 6A,  1,  E, 68, 7DC
9DC    DATA 53,  4, 9A, FF, FF,  8,  0, C3, 6A,  2,  B, 68, 53,  4, 9A, 23, 5A8
9F2    DATA  4,  8,  0, C3, FF, 36, CD, 8A, 6A,  8, FF, 36, E7, 8A, 6A,  8, 69D
A08    DATA 6A,  8, 6A,  8, 9A, FF, FF,  8,  8, FF, 36, C5, 8A, 9A, B8,  1, 743
A1E    DATA  8,  8, C3, B8, DE, FF, 6A,  3, 6A,  8, 6A,  8, 9A, 2F,  4,  8, 596
A34    DATA  8, 2B, DB, A1, 6A,  1,  E,  6, 6C,  1, 89, 1B, 8A,  1, 89, 1E, 449
A4A    DATA 6C,  1, 89, 1E, BD, 8A, BB, E7,  A, 74,  9, BA, E7,  A, B9,  8, 68B
A60    DATA 88, B8, 7E,  1, C3, E8, 37,  1, 72,  C, B8, 12,  1, 72,  7, 3C, 617
A76    DATA  A, 75, F7, B0, DB,  8, C3, 8E,  E, A7,  A, 49, E8, B6, FF, B2, 93E
A8C    DATA FB, C3, C7,  6, BD, 8A,  8,  8, C3, A8, 69,  1, 2A, E4,  1,  6, 6B4
AA2    DATA BD, 8A, C3, 8B, DE, E8, 14,  8, 3B, DB, 75, F7, C1, E8, B1,  0, 958
AB8    DATA 72,  9, B8, AC,  8, 72, C3, 3C,  A, 75, F7, C3, 8B,  B, A7,  A, 782
ACE    DATA 49, B8, B9, FF, B2, FE, C3,  6, C4, 3B, C1, 8A, 8B,  B, B7, 8A, 9B6
AE4    DATA D1, E9, B8, 2B, 8A, 26, 5B,  1, F3, AE, 8B,  B, A5,  A, 8B, 3B, 745
AFA    DATA C1, 8A, BE, 98,  9, AC,  A, C8, 74,  7, 8A, 26, 62,  1, AB, B2, 733
B10    DATA F4, 8E, 36, B9, 8A, B2,  1, A8, A5,  A, 2A, E4,  3,  6, BD, 8A, 758
B26    DATA A3, BF, 8A, 2B, DB, AE, A5,  A, F6, B2,  3, C8, 8B, F8,  3, 3B, 8A8
B3C    DATA C1, 8A, E8, 4C,  8, 72, 3B, 3C,  D, 74, F7, 1C,  A, 74, 2B, 3C, 681
B52    DATA  9, 74, 19, B9,  1,  0, 3B, 1B, BD, 8A, 72,  B, 3B, 1E, BF, 8A, 58F
B68    DATA 73,  5, 8A, 26, 5B,  1, AB, 43, E2, EC, EB, D6, 8E, C3, 25,  7, 77E
B7E    DATA  0, B9,  8,  8, 2B, C8, 8B, 2D, EB, DC, FE, C2, 3A, 16, A7,  A, 78C
B94    DATA 72, B1, 6A,  8, FF, 36, B7, 8A, 8A,  8, 9A, FF, FF,  8,  8,  7, 78C
BAA    DATA C3, 3B, 36, BB, 8A, 73, 46, 81, FE, B7, 8A, 72, 3C, 51, 52, 57, 79A
BC0    DATA  6, 1B,  7, EE, B7, 8A, BF, E7,  A, B9,  8, 48, 29,  A, E9, 8A, 50D
BD6    DATA F3, A4, 8B, F7, 81,  6, 6A,  1,  0, 88, 83, 16, 6C,  1,  8, BA, 64B
BEC    DATA B7, 4A, B9,  8, 48, B8, 59,  0, 81, 2B, 6A,  1,  8, 48, 83, 1B, 536
C02    DATA 6C,  1,  8,  7, 5F, 5A, 59, EB, E8, AC, 24, 7F, F9, F5, C3, 81, 7AA
C18    DATA FE, B7,  A, 77, 34, A1, 6A,  1,  B,  6, 6C,  1, 74, 31, 51, 52, 53C
C2E    DATA  6, 1B,  7, BB, B7,  A, BF, E7, BA, B9,  8, 48,  1,  B, B9, 8A, 5B5
C44    DATA F3, A4, 81, 2B, 6A,  1,  8, 48, 83, 1B, 6C,  1,  8, BA, B7,  A, 57A
C5A    DATA B9,  8, 48, B8,  B,  8,  7, 5A, 59, 4B, 8A,  4, 24, 7F, F9, F5, 613
C70    DATA C3, 58, 53, C7,  6, B0, 8A, FF, FF, FF, 36, C5, 8A, FF, 36, 6C, 99E
C86    DATA  1, FF, 36, 6A,  1, 6A,  8, 1B, 68, C9, 8A, 9A, FF, FF,  8,  0, 67C
C9C    DATA 8B, 1E, C5, 8A, B8, 3A, FE,  E, C8, A1, B8,  9, 74,  2, 2B, C8, 7CB
CB2    DATA 3B, C1, 74,  5,  3, C2, A3, BB, 8A, 5B, 58, C3, 1A,  0,  2,  0, 5B4
CC8    DATA AE,  0,  2,  0,  0,  0,  3,  1, C1,  1,  2,  0,  5,  0,  3,  1, 100
CDE    DATA 5D,  4,  1,  8,  7,  8,  3,  1, 6A,  1,  2,  0, B9,  8,  3,  1, 166
CF4    DATA 78,  1,  1,  8, 8A,  8,  3,  1, D2,  0,  2,  0, 18,  8,  3,  1, 1EF
D0A    DATA EB,  0,  1,  8, 91,  8,  3,  1, C6,  3,  1,  8, 1A,  8,  3,  1, 268
D20    DATA BA,  3,  1,  0, 1B,  8,  3,  2, D3,  3,  2,  8, 13,  0,  3,  1, 1CD
D36    DATA 90,  3,  1,  0, 22,  8,  3,  2, 7D,  3,  2,  8, 26,  8,  3,  1, 168
D4C    DATA EB,  2,  1,  8, 39,  8,  3,  1, 1C,  6,  1,  8, 3A,  8,  3,  1, 19F
D62    DATA 4B,  4,  1,  8, 3B,  8,  3,  1,  B,  3,  1,  8, 3F,  0,  3,  1,  B4
D78    DATA B0,  2,  1,  8, 48,  8,  3,  2, 4F,  3,  3,  8, 3B,  8,  3,  1, 101
D8E    DATA  1,  3,  1,  8, 41,  8,  3,  1, 36,  3,  1,  8, 46,  0,  3,  1,  CB
DA4    DATA B6,  1,  1,  8, 47,  8,  3,  1, 5D,  1,  1,  8, 48,  8,  3,  2, 222
DBA    DATA A7,  3,  3,  8, 1B,  8,  3,  1, 2A,  0,  1,  8, 51,  0,  3,  2, 16D
DD0    DATA 6B,  5,  3,  0, 4A,  8,  3,  2, 45,  4,  3,  8, 55,  0,  0,  0, 163
DE6    DATA  D,  A, 53, 76, 6B, 74, 61, 70, 2A, 20, 46, 53, 42, 20, 66, 66, 4C2
DFC    DATA 6C, 65, 73, 70, 65, 63,  D,  A,  D,  A, 46, 66, 6C, 65, 20, 53, 46D
E12    DATA 65, 61, 72, 63, 68, 28, 61, 6E, 64, 28, 42, 72, 6F, 77, 73, 65, 5E8
E28    DATA 20, 28, 63, 26, 20, 31, 16, 3F, 30, 2C, 28, 5A, 66, 66, 66, 20, 3C6
E3E    DATA 43, 6F, 6D, 6D, 75, 6E, 66, 62, 61, 74, 69, 6F, 6E, 73, 20, 43, 62C
E54    DATA 6F, 2B,  D,  A, 50, 43, 28, 4D, 61, 67, 61, 7A, 69, 6E, 65, 28, 4B3
E6A    DATA FE, 28, 43, 68, 61, 72, 6C, 65, 73, 20, 5B, 65, 74, 7A, 6F, 6C, 67E
E80    DATA 64, 2C, 28, 31, 2F, 38, 18,  E,  A,  8, 46, 53, 42, 3A, 28, 46, 317
E96    DATA 6E, 76, 61, 6C, 69, 44, 3B, 64, 66, 73, 6B, 28, 64, 72, 66, 76, 61E
EAC    DATA 65,  0, 46, 53, 42, 3A, 20, 49, 6E, 76, 61, 6C, 66, 64, 28, 66, 4E5
EC2    DATA 66, 72, 65, 63, 74, 6F, 72, 79,  8, 46, 53, 42, 3A, 28, 46, 6E, 55D
ED8    DATA 76, 61, 6C, 69, 64, 28, 66, 66, 6C, 65, 28, 73, 70, 65, 63,  0, 56E
EEE    DATA 46, 53, 42, 3A, 20, 43, 61, 6E, 6E, 6F, 74, 20, 6E, 6F, 74, 28, 529
F04    DATA 63, 72, 65, 61, 74, 65, 20, 70, 66, 70, 65,  0, 46, 53, 42, 3A, 557
F1A    DATA 20, 43, 61, 6E, 6E, 6F, 74, 20, 6E, 6F, 74, 20, 63, 61, 6C, 63, 5AF
F30    DATA 74, 65, 28, 73, 65, 63, 6F, 6D, 64, 20, 74, 68, 72, 65, 61, 64, 68D
F46    DATA  0,  6, 46, 53, 42, 3A, 28, 43, 61, 6E, 6E, 6F, 74, 20, 6F, 70, 4A8
F5C    DATA 65, 6E, 20, 66, 66, 6C, 65, 20, 66, 6F, 72, 28, 72, 65, 61, 64, 5B6
F72    DATA 66, 6E, 67,  D,  A,  0,  6, 46, 53, 42, 3A, 2B, 55, 6E, 73, 76, 43B
F88    DATA 78, 78, 6F, 72, 74, 65, 64, 28, 76, 69, 64, 65, 6F, 28, 6D, 6F, 631
F9E    DATA 64, 65,  D,  A,  0, 5C,  0,  9, 20, 3C, 3B, 3D,  0,  1, 2E, 2E, 266
FB4    DATA  0, 2A, 2E, 2A,  0, 41, 54, 54, 52, 31, 3D, 1E, 41, 54, 54, 52, 104
FCA    DATA 32, 3D, 4F, 53, 40, 49, 46, 54, 3D,  0, FF, FF, FF, FF, 61,  4, 6E2
FE0    DATA 05,  4, 67,  4, 84,  4, A2,  4, 84,  4, A9,  4, 84,  4, E1,  4, 4C6
FF6    DATA 8D,  4, CC,  4,  8,  8,  8,  0,  0,  0,  8,  8,  8,  8,  8,  8, 181
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Figure 2: *A BASIC program you can type in and run to create FSB.EXE.*

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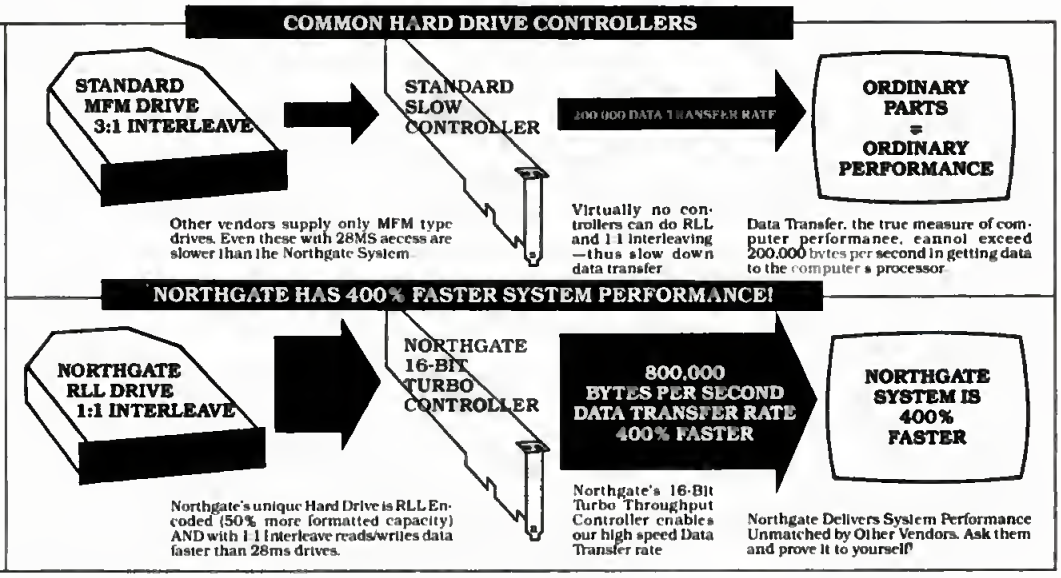
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anything else to be going on until you press a cursor key. Yet the disk is being accessed by the second thread.

To prevent the concurrent file search from slowing down the browse screen update, FSB simply suspends the second thread while updating the display:

```
Push      ThreadID
OS2Call   DosSuspendThread

Call      UpdateScreen

Push      ThreadID
OS2Call   DosResumeThread
```

FINDING FILES OS/2 has two functions for doing file searches: DosFindFirst and DosFindNext. These work similarly to the DOS file find functions, but there are some important differences.

The first difference is that OS/2 has nothing resembling the Default Transfer Area (DTA). The DTA in DOS was inherited from CP/M and became almost unnecessary when the handle-based file I/O functions were introduced in DOS 2.0. However, the DOS 2.0 file find function calls continued to use the DTA. The OS/2 functions replace the DTA with a structure called (in the OS/2 C header files) FileFindBuf.

Second, OS/2 lets you find multiple files with one function call. Obviously, the buffer area must be large enough to hold them all. In C, you'd use an array of FileFindBuf structures rather than just one structure. One parameter of DosFindFirst and DosFindNext is an address of a "search count." You set this to the maximum number of files you wish to find before making the function call. On return from the call, OS/2 sets the variable to the actual number of files it found. FSB doesn't take advantage of this facility, however—for structural simplicity, it tries to find one file or directory at a time.

The third difference is that OS/2 introduces the concept of a "directory handle." This allows a process to have many different file finds in process at the same time. (You could do this under DOS by resetting the DTA for each find.)

If an OS/2 program needs to do only one file search at a time, it can set the handle to 1 before the DosFindFirst function. This is the only option that is allowed if the program is to be made into a dual-mode (or family) program that runs under both OS/2 and DOS. Otherwise, the program sets the directory handle to −1 (or FFFFh) before the DosFindFirst call. OS/2 assigns a unique handle on return from the call. The program then uses this handle in subsequent DosFindNext calls and eventually closes the handle with DosFindClose. FSB uses the directory handle approach because it must be able to maintain several different file finds at the same time. When the FindThem function searches for nested directories, it recursively calls the FindThem routine for each directory that it finds. The directory handle is stored on the stack, so each recursive call to FindThem can use a new directory handle.

THE PIPE Threads within a process must often communicate with each other. For example, in FSB the second thread must pass all the filenames it has found to the first thread.

Threads within the same process have separate stacks but otherwise share all the memory that belongs to the process. Thus, intraprocess communication between threads is often much easier than interprocess communication.

■ Threads within the same process have separate stacks but otherwise share all the memory of the process, making communication easier.

In FSB, I could have allowed the second thread to give the filenames to the first thread by setting up a first-in/first-out (FIFO) circular buffer, something like a keyboard buffer except that it holds 80-byte character strings. I would have needed a function to put a string into the buffer and a function to remove a string.

Instead, however, I used a FIFO facility built into OS/2, called a *pipe*. A pipe is a block of memory (up to 64K in length) that can almost be treated as if it were a file, and it is one of the simpler forms of interprocess communication OS/2 provides.

OS/2 has only one function specific to pipes, called DosMakePipe. In C, the call to DosMakePipe looks like this:

```
unsigned int PipeReadHandle ;
unsigned int PipeWriteHandle ;
      ....
DosMakePipe (&PipeReadHandle,
     &PipeWriteHandle, PipeSize) ;
```

The two pipe handles can then be used with the DosRead, DosWrite, and DosClose function calls, which are the same functions a program uses when working with files or when reading standard input or writing to standard output. However, a program must write to and read from a pipe sequentially. You cannot change the file read/write pointer when working with a pipe.

Pipes are often used for redirecting standard input and standard output. When you run a command such as

```
DIR | SORT
```

CMD.EXE makes a pipe by calling DosMakePipe. It then uses the DosDupHandle function so that the standard output handle for DIR is the same as the pipe write handle, and the standard input handle for SORT is the same as the pipe read handle. The DIR and SORT commands run concurrently. As DIR writes to the pipe, SORT reads from the pipe.

FSB uses the pipe so that the second thread can store fully qualified filenames that it finds and the first thread can retrieve them, so both threads use the pipe handle.

If the pipe is empty and a program tries to read the pipe using the DosRead function, then the DosRead call will be suspended until the pipe gets some more data written into it. Only when the pipe write handle is closed (using DosClose) will the DosRead function return with 0 bytes read. This indicates an "end of file" for the pipe. This is very important—the first time you use pipes you're likely to forget to close the write handle. The program will hang.

EXIT LIST PROCESSING Another FSB function I haven't discussed in previous Environments columns is DosExit-

List. This function allows you to specify certain routines that OS/2 will execute as your program is being terminated.

OS/2 programs normally terminate by calling DosExit, but they can also be terminated in other ways. For example, if the program accesses a device (such as a disk) that suffers a critical error, OS/2 displays a pop-up screen that offers the user a choice to abort, retry, or fail the operation. If the user chooses to abort, then OS/2 will terminate the program. OS/2 will also terminate a program when a user types Ctrl-Break or Ctrl-C (unless the program has set a new "signal handler" for Ctrl-Break).

FSB allows you to terminate the program by typing Ctrl-Break. But if the full-screen browse display were present when you typed Ctrl-Break, then the OS/2 command line prompt would appear somewhere in the middle of the display and it would look like a mess.

For this reason, FSB calls DosExitList in the Browse function while the full-screen display is present. The exit list routine restores the screen during termination.

DOS programmers might be tempted to see exit list processing as a way to restore the disk drive and directory that were in effect when the program originally began. However, this is not necessary under OS/2. Each process has its own current disk drive and subdirectory. A process changes only its own current disk drive and directory and not that of any process. After a program exits and CMD.EXE takes over, CMD.EXE's own current disk drive and directory are once again in effect for the session.

NO MORE DEAD TIME In an interactive environment such as DOS or OS/2, there's usually a lot of dead time during which a program is waiting for a keystroke from the user. In a single-tasking operating system such as DOS, dead time remains dead and wasted. But in a multitasking system such as OS/2, dead time can be resurrected and put to good use. The overall result is faster throughput.

So, the next time somebody tries to tell you that multitasking and OS/2 slow down the system, you may want to consider why they're still raising these false issues. Let's hope it's because they just don't know any better. PC

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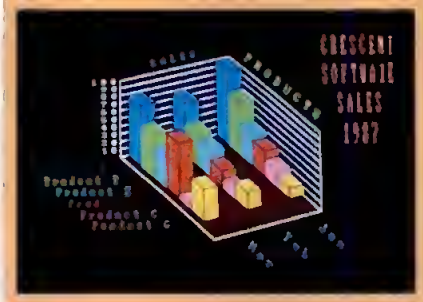
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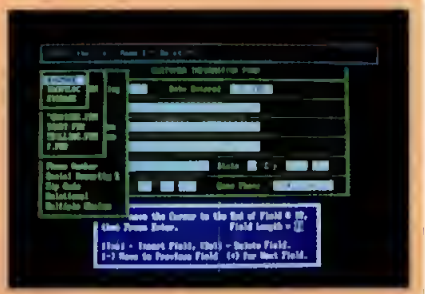
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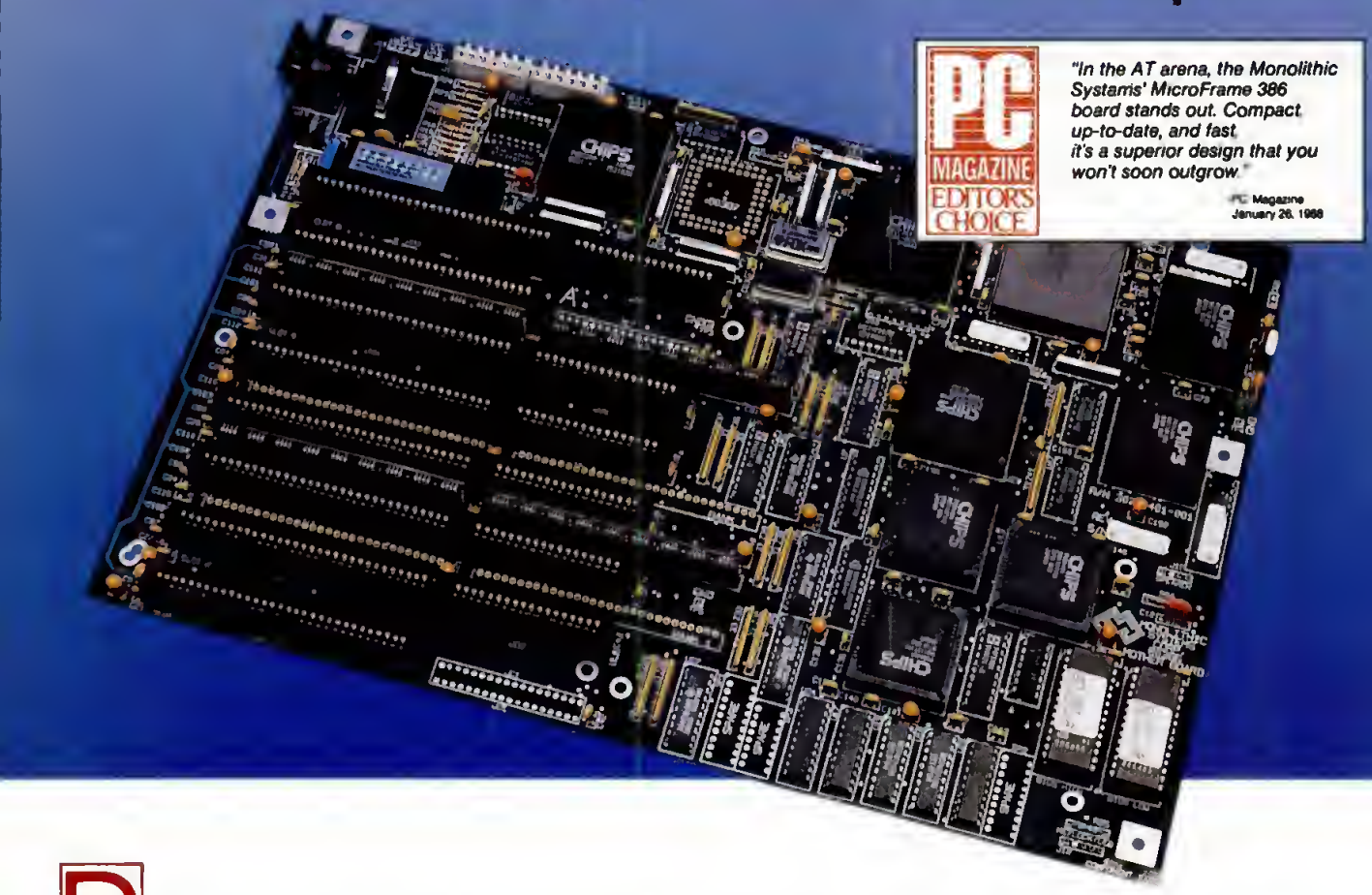
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PC Magazine
January 26, 1988

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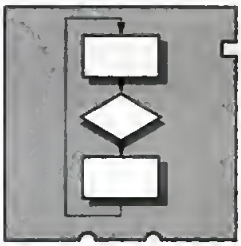
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■ POWER PROGRAMMING ■ RAY DUNCAN

HANDLING DATE AND TIME STRINGS IN C



C routines that convert ASCII times and dates into binary format supply practical solutions to typical programming problems and show how easy it is to support different national formats.

In the last three issues I've presented C and MASM routines for converting binary times and dates to ASCII strings and MASM routines to convert ASCII strings to binary times and dates. (See the tables "MASM/C Language Power Programming Time and Date Routines"). In this column I'll conclude that subject with C language routines to convert ASCII dates and times to binary.

Time and date strings, which involve several fields with special delimiters, present more typical problems with user input than the examples in most C or MASM programming books. They also show how easy it is to incorporate internationalization support.

THE SCANTD.C ROUTINES The SCANTD.C listing shown in Figure 1 contains the source code for two public routines: `scandate` and `scantime`. As with the MASM routines of the same name presented in my last column, `scandate` converts an ASCII string of the form

`mm/dd/yy`

to a binary date, and `scantime` converts an ASCII string of the form

`hh:mm:ss`

to a binary time (*SS* field is optional).

Both routines accept pointers to strings and to variables that will receive the converted field values. They perform a moderate amount of validation on the strings they process by checking for the absence of fields, fields that have "unreasonable" values, or characters that are not numeric digits or legal delimiters. If the supplied string is invalid for any of these reasons, the functions return a false flag; if all fields in the string have reasonable values and are separated by correct delimiters, the functions return a true flag.

The table "Scandate and Scantime Calling Sequences" summarizes the arguments and results of the two functions. They have been designed to be easy to use in the same program with the `tcvt` (convert time to ASCII) and `dcvt` (convert

MASM Power Programming Time and Date Routines

Name	Function	Issue
`tcvt`	Convert binary time to ASCII	May 31, 1988
`dirtcvt`	Convert directory time to ASCII	May 31, 1988
`systcvt`	Convert current time to ASCII	May 31, 1988
`dcvt`	Convert binary date to ASCII	May 31, 1988
`dirdcvt`	Convert directory date to ASCII	May 31, 1988
`sysdcvt`	Convert current date to ASCII	May 31, 1988
`scantime`	Convert ASCII time to binary	June 14, 1988
`scandate`	Convert ASCII date to binary	June 14, 1988

C Language Power Programming Time and Date Routines

Name	Function	Issue
`tcvt`	Convert binary time to ASCII	May 17, 1988
`dirtcvt`	Convert directory time to ASCII	May 17, 1988
`systcvt`	Convert current time to ASCII	May 17, 1988
`dcvt`	Convert binary date to ASCII	May 17, 1988
`dirdcvt`	Convert directory date to ASCII	May 17, 1988
`sysdcvt`	Convert current date to ASCII	May 17, 1988
`scantime`	Convert ASCII time to binary	June 28, 1988
`scandate`	Convert ASCII date to binary	June 28, 1988

The assembly language versions of the time and date routines, plus the C source code we've presented in this column, are available for each of the above routines in the indicated issue.

date to ASCII) functions published here in our May 17, 1988, issue.

HOW SCANTD ROUTINES WORK

The only "helper" routine in SCANTD.C is `getctry`, which was also previously used in the TD.C file. It is declared as static so that the scope of its name is limited to this module. `Getctry` checks the MS-DOS version and, if Version 2.0 or later, it calls the Get Current Country function (interrupt 21h function 38h) to obtain the "date format code" of the system. The Get Current Country function also returns other information, but since the format of that information differs from version to version of MS-DOS, I've chosen to ignore it here.

```
/*
    SCANTD.C    Convert ASCII times and dates to binary

    by Ray Duncan, February 1988
*/

#include <stdio.h>
#include <dos.h>

union REGS regs;

                                /* function prototypes */
static void getctry(void);
int scantime(char *, int *, int *, int *);
int scandate(char *, int *, int *, int *);


                                /* table of days of the month */

static int dom[] = {    31,     /* January   */
                        28,     /* February  */
                        31,     /* March     */
                        30,     /* April     */
                        31,     /* May       */
                        30,     /* June      */
                        31,     /* July      */
                        31,     /* August    */
                        30,     /* September */
                        31,     /* October   */
                        30,     /* November  */
                        31 };   /* December  */

static char cbuff[34];          /* receives country info */

static int cflag = 0;           /* true if country info */
                                /* present in cbuff */



/*
    Convert ASCII string into binary hour, minute, and second.
*/

int scantime(char *timestr, int *hour, int *min, int *sec)
{
    *hour = *min = -1;          /* force hours and minutes
                                   to be entered */

    *sec = 0;                   /* allow seconds to default
                                   to zero */

                                /* validate time string */

    if( strspn(timestr,"0123456789:") != strlen(timestr) )

        return(0);              /* exit if bad characters */

                                /* convert fields of input
                                   using ':' as delimiter  */
    sscanf(timestr, "%d:%d:%d", hour, min, sec);

                                /* check all results against
                                   allowed values and return
                                   flag for overall conversion */

    return( ( ( *hour>=0 ) && ( *hour<24  ) )  &&
            ( ( *min>=0  ) && ( *min<60   ) )  &&
            ( ( *sec>=0  ) && ( *sec<60   ) ) );
}


/*
    Convert ASCII string into binary month, day, and year.
*/

int scandate(char *datestr, int *month, int *day, int *year)
{
    char sep1[2],sep2[2];       /* these little arrays receive
                                   date separators from scanf */

    *month = *day = *year = -1; /* user must enter all fields */
                                /* now validate date string */

    if( strspn(datestr,"0123456789/-.") != strlen(datestr) )

        return(0);              /* exit if bad characters */

    getctry();                  /* get country info */


                                /* convert fields of input
                                   according to current
                                   country, using '-', '/',
                                   or '.' as delimiter  */

    switch(cbuff[0])            /* switch on date code */
    {
        case 0:                 /* USA: m d y */
        sscanf(datestr, "%d%1s%d%1s%d", month, sep1, day, sep2, year);
        break;

        case 1:                 /* Europe: d m y */
        sscanf(datestr, "%d%1s%d%1s%d", day, sep1, month, sep2, year);
        break;

        case 2:                 /* Japan: y m d */
        sscanf(datestr, "%d%1s%d%1s%d", year, sep1, month, sep2, day);
        break;
    }

                                /* allow entry of complete year
                                   and correct it if necessary */

    if( (*year>=1988) && (*year<=1999) ) *year-=1900;

                                /* set up days of month table */
    if( (*year%4) == 0 )        /* if leap year ...           */
        dom[1] = 29;            /* then February = 29 days    */
    else dom[1] = 28;           /* else February = 28 days    */
                                /* check all results against
                                   allowed values and return
                                   flag for overall conversion */

    return( ( ( *month>0  ) && ( *month<=12 ) )  &&
            ( ( *day>0    ) && ( *day<=dom[*month-1] ) )  &&
            ( ( *year>=88 ) && ( *year<=99  ) ) );
}


/*
    Get MS-DOS international information into
    'cbuff', or provide default information.
*/

static void getctry(void)
{
    int dosver;

    if(cflag) return;           /* exit if information
                                   already in buffer */

    memset(obuff,0,34);         /* initialise buffer */

    regs.x.ax = 0x3000;         /* get MS-DOS version */
    int86(0x21, &regs, &regs);
    dosver = regs.h.al;

    if(dosver >= 2)             /* if MS-DOS 2.x or 3.x */
    {                           /* get country info */
        (char *) regs.x.dx = cbuff;
        regs.x.ax = 0x3800;
        int86(0x21, &regs, &regs);
    }

    if(dosver <= 2)             /* if MS-DOS 1.x or 2.x */
    {                           /* force delimiter info */
        cbuff[9]  = '.';        /* decimal separator */
        cbuff[11] = '/';        /* date separator */
        cbuff[13] = ':';        /* time separator */
    }

    cflag = -1;                 /* we've been here before */
}
```

Figure 1: *The SCANTD.C source code for converting ASCII time and date routines.*

Scandate and Scantime Calling Sequences

scandate

Usage

status = scandate(buffer, &month, &day, &year);

Parameters

```
char buffer[80];        /* holds ASCII date string */
int month,day,year;     /* receive converted values */
int status;             /* conversion success flag */
```

Explanation

Converts each field of an ASCII date string into binary. The month, day, and year fields are separated by a slash (/), hyphen (-), or decimal (.) delimiter. The order of the fields is determined by the current country code. Status is returned true if date was valid, false if date was incomplete or contained illegal characters or values.

scantime

Usage

status = scantime(buffer, &hour, &min, &sec);

Parameters

```
char buffer[80];        /* holds ASCII time string */
int hour,min,sec;       /* receive converted values */
int status;             /* conversion success flag */
```

Explanation

Converts each field of an ASCII time into binary. The hour, minute, and seconds fields are separated by a colon (:) delimiter. The seconds field is optional. Status is returned true if time was valid, false if time was incomplete or contained illegal characters or values.

The date format code determines the order in which month, day, and year will be entered and displayed: 0 for the *mm/dd/yy* format (USA), 1 for the *dd/mm/yy* format (Europe), and 2 for the *yy/mm/dd* format (Japan). The code is set as a result of a COUNTRY= directive in the CONFIG.SYS file. If no COUNTRY= directive is found at boot time, the default date format code is determined by the OEM that produced your version of MS-DOS.

The `scandate` and `scantime` routines themselves are not overly complex—especially when compared with the MASM equivalents we looked at last time. They use some of the handy C string and conversion library functions to validate and parse the ASCII strings. In particular, `strspn` is called to validate a string by making sure that each of its characters is either numeric or a delimiter, and `sscanf` is called to convert each numeric field to binary and leave the results in the caller's variables.

The internationalization support in `scandate` is implemented by a CASE statement that "switches" on the date format code obtained by `getctry`. It works by simply passing `sscanf` the addresses of the variables to receive the results in a different order. The variables for required input fields are forced to −1 before the call to `sscanf` so that if a field is missing, the

```
/*
    TRYSTD.C:   Demo of time and date conversion
                routines in SCANTD.C and TD.C.

    By Ray Duncan, February 1988

    Compile:    C>CL TRYSTD.C TD.C SCANTD.C <Enter>

*/

#include <stdio.h>

                                    /* prototypes for TD.C */

extern char * tcvt(int, int, int, int, int);
extern char * dcvt(int, int, int, int);

                                    /* prototypes for SCANTD.C */

extern int scantime(char *, int *, int *, int *);
extern int scandate(char *, int *, int *, int *);

main()
{
    char buffer[80];                /* used for keyboard input */

    int month,day,year;             /* binary date from scandate */
    int hour,min,sec;               /* binary time from scantime */

    int status;                     /* flag from scantime or scandate */
                                    /* <>0 if valid date or time */

    while(1)

    {   printf("\n\nEnter date: "); /* prompt user for date */
        gets(buffer);               /* input date */

        if(buffer[0]==0) exit(0);   /* if no entry, exit */

                                    /* convert ASCII date to
                                       binary month, day, year */

        status = scandate(buffer,&month,&day,&year);

                                    /* if valid, convert back
                                       to ASCII and display */

        if(status) printf("You entered: %s", dcvt(0,month,day,year));

        else printf("Bad date!");   /* otherwise error message */

        printf("\n\nEnter time: "); /* prompt user for time */

        gets(buffer);               /* input time */

        if(buffer[0]==0) exit(0);   /* if no entry, exit */

                                    /* convert ASCII time to
                                       binary hours, min, sec */

        status = scantime(buffer,&hour,&min,&sec);

                                    /* if valid, convert back
                                       to ASCII and display */

        if(status) printf("You entered: %s", tcvt(0,hour,min,sec,0));

        else printf("Bad time!");   /* otherwise error message */

    }
}
```

Figure 2: *The TRYSTD.C source code that illustrates* `scantime` *and* `scandate` *routines.*

variable will have an illegal value; variables for optional fields are assigned a default value of 0.

The `scandate` function is rather tolerant about the user's entry for the century; it accepts either the full year (1980 to 1999) or a two-digit year (80 to 99). It is perceptive about days of the month; if the month is valid, it uses a table to determine the maximum day for that month and corrects the days in February for leap year.

Once all fields are converted, their values are checked within the return statement by carrying out an exhaustive set of comparisons. The flags from all the comparisons are logically ANDed together to obtain a single true or false flag. Looking at the code for the return statement, you might be tempted to think of all the wasted effort spent if one of the early values tested is bad. But the compiler is smart: since it knows all values are going to be ANDed together and any false result will govern the overall result, it short-circuits the sequence of comparisons at the first false flag.

SCANTD ROUTINES IN ACTION The program TRYSTD.C (Figure 2) demonstrates use of the `scantime` and `scandate` routines. It prompts the user for a date entry, converts the date to binary with `scandate`, reconverts the binary date to ASCII with `dcvt`, and displays it. It then prompts the user for a time entry and goes through a similar two-way conversion and display with `scantime` and `tcvt`. The demo program may be terminated at any time by pressing the Enter key alone in response to a prompt or by entering Ctrl-C (^C).

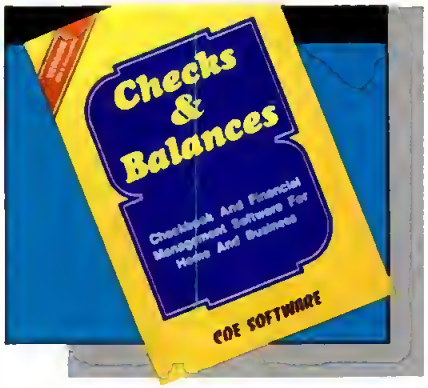
To use the TRYSTD.C demo program, you will need the files TRYSTD.C, SCANTD.C, and TD.C, which were presented in the May 17, 1988, issue. If you have Microsoft C 5.0, you can compile all three of these modules and link them together into the executable file TRYSTD.EXE by entering the command

```
CL TRYSTD.C SCANTD.C TD.C
```

You can test the internationalization support by adding the line COUNTRY=049 (West Germany) to the CONFIG.SYS file on your boot disk and restarting the system. TRYSTD will then require that you enter dates in the format *dd/mm/yy* (or *dd-mm-yy* or *dd.mm.yy*) and will display them in the same format.

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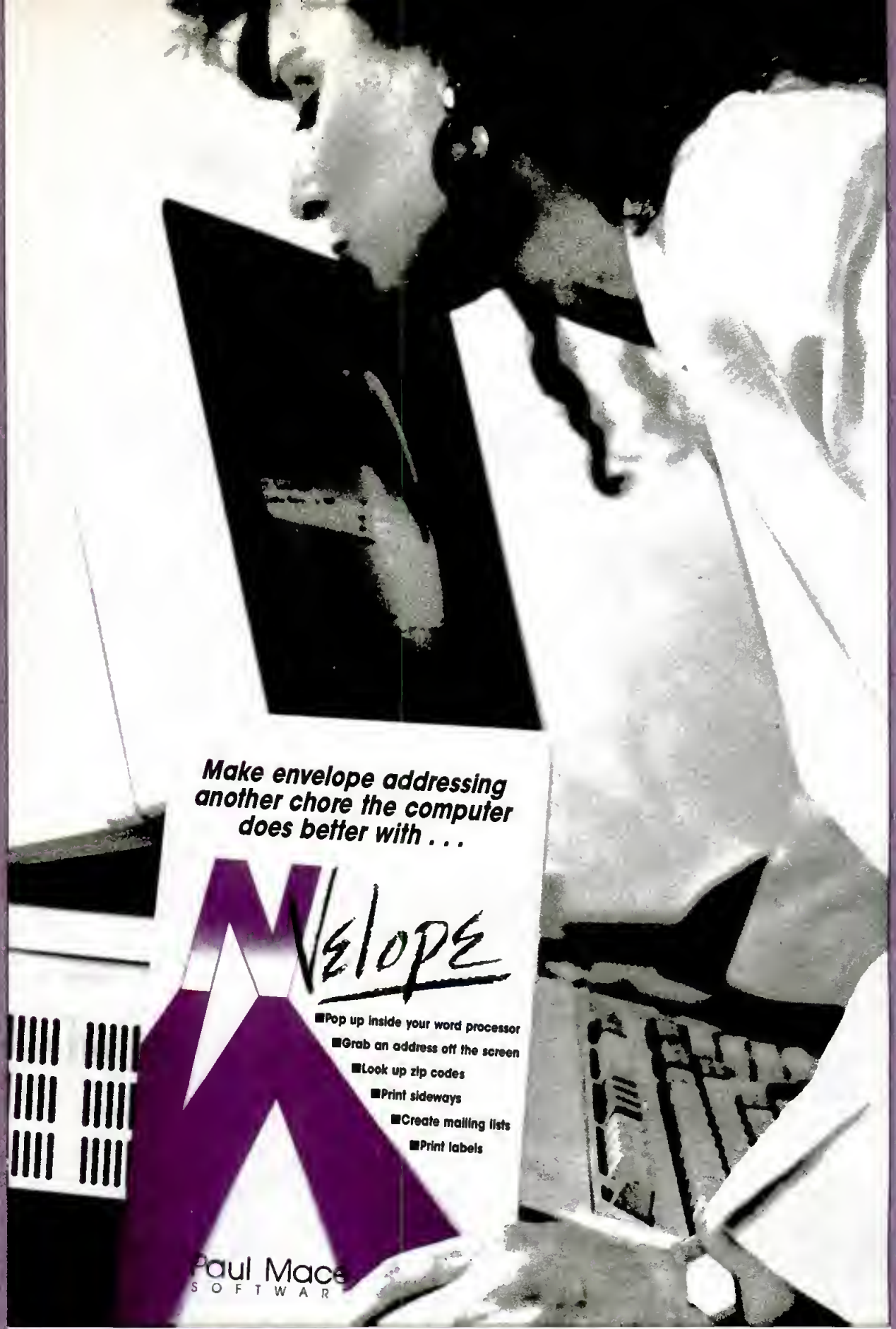
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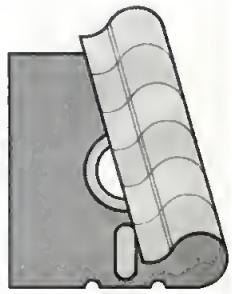
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■ DOUGLAS COBB AND STEVEN COBB

SPREADSHEET CLINIC



Calculating more-precise values with @VLOOKUP; loading SuperCalc automatically; eliminating unnecessary recalculations in 1-2-3; keying into F3's versatility.

THE PROBLEM OF 1900

In the December 22, 1987, Spreadsheet Clinic, Scott Strehlow recommended the use of the function

```
@CHOOSE(@MOD($D$3,7),
"Saturday","Sunday","Monday",
"Tuesday","Wednesday","Thursday",
"Friday")
```

[*The above is a single entry.—Ed.*] to compute the day of the week that corresponds to the serial date value in cell D3 of a *1-2-3*, Release 2, worksheet. Unfortunately, because of an inaccuracy in *1-2-3*'s calendar, this function returns the correct result only for dates starting from March 1, 1900, on.

The problem is that *1-2-3* thinks that 1900 was a leap year, when in fact it was not. Consequently, since *1-2-3* incorrectly thinks that February 29, 1900, is a valid day, all dates from March 1, 1900, on have a serial value that is one day too high. The formula submitted by Mr. Strehlow corrects for this. In doing so, however, it renders itself inaccurate for dates prior to that point. For example, his function would tell you that February 28, 1900, was a Tuesday, when in fact it was a Wednesday.

The following function compensates for this problem:

```
@IF(DATECELL=60,@ERR,
@CHOOSE(@MOD(
@IF(DATECELL>60,DATECELL,
DATECELL+1),7),
"Saturday","Sunday","Monday",
"Tuesday","Wednesday","Thursday",
"Friday")
```

If the date in question is February 29, 1900 (a date that only *1-2-3* thinks exists), this function will return the value ERR. If the date falls after February 29, 1900, this function works in exactly the same way that the original one does. If the date falls prior to February 29, 1900, this function adjusts by adding 1 to the serial value of that date before evaluating the @MOD function.

Rajeev D. Sharma
Moscow, U.S.S.R.

This problem with the year 1900 has plagued every release of 1-2-3, *including Release 1A. Fortunately, most* 1-2-3 *users don't work with dates at the beginning of* 1-2-3*'s calendar. Those who do will want to use Mr. Sharma's function.*

PHANTOM RECALCULATIONS

I recently encountered a peculiar quirk in *Lotus 1-2-3*. When *1-2-3* executes a /Print Printer command after executing a {For} loop, it recalculates the worksheet before printing, even if the worksheet is set for Manual recalculation. If the worksheet you are printing is large, this unnecessary recalculation can cause a significant delay.

The macro shown in Figure 1 demonstrates this odd behavior. The macro starts by setting the worksheet for Manual recalculation and moving the cell pointer to cell F1. The third statement assigns the D6 format to cells F1..F5, and the fourth statement sets up a {For} loop to be executed five times. During each pass through the loop, *1-2-3* enters the function @NOW into the current cell, waits 1 second, and then moves the cell pointer down one cell. At the end of the fifth pass, cells F1..F5 all will contain the function @NOW. However, since the worksheet is set for Manual recalculation, and since the macro waited 1 second after each entry, each function will return a value 1 second greater than the previous one.

```
     A          B                    C
1    \a         /wgrm
2               {Goto}F1~
3               /rfdt1{down 4}~
4               {For COUNT,1,5,1,LOOP}
5               /pprF1..F5~agq
6
7    LOOP       @NOW~
8               {Wait @NOW+@TIME(0,0,1)}
9               {Down}
10
11   COUNT
12
```

Figure 1: 1-2-3 *will recalculate before it prints if the /Print command follows a {For} loop.*

After making these entries, *1-2-3* executes the statement in cell B5, which commands it to print the results of the functions in cells F1..F5. Before it prints, however, *1-2-3* will recalculate the worksheet. Consequently, all five functions will return the same value—the time at which the worksheet was recalculated immediately prior to printing. Fortunately, there is an easy way to avoid this unnecessary (and unwanted) recalculation: simply follow the {For} statement with a tilde (~). For some reason, this tilde eliminates *1-2-3*'s desire to recalculate the worksheet prior to printing. Lotus is looking into this problem but does not yet have an explanation for what causes it.

Howard R. Kirkland
Kansas City, Missouri

1-2-3, *Releases 2 and 2.01, exhibits this behavior, but* Symphony *does not. Includ-*

■ SPREADSHEET CLINIC

ing a ~ after a {For} statement does seem to eliminate the unnecessary recalculation, however, as Mr. Kirkland discovered.

MORE ON THE F3 KEY

In the Spreadsheet Clinic of December 22, 1987, Marshall Durbin explained that if you press F3 after hitting the Goto key, *1-2-3* will display a list of the named ranges in the worksheet in a line across the top of the screen. If you press the F3 key again (or for the first time when issuing the /Range Name Create or /Range Name Delete commands), *1-2-3* will expand the list to full-screen size.

A couple of additional comments are in order. First, although you will most commonly use F3 with the Goto key and the /Range Name Create commands, you can use it in conjunction with a variety of other commands. For example, you can use it when specifying the To and From ranges of a /Copy or /Move command and when using the /Range Erase command. This feature makes it easy to copy, move, or erase a named range.

Second, the F3 key is not quite as versatile in Release 1A as it is in later releases of *1-2-3*. Although pressing F3 once does reveal a line of range names at the top of the screen, pressing it again does not expand the list to cover the entire screen. However, once you have revealed the line of range names, you can use the Up and Down Arrow keys to move to different "rows" of the list, just as if the range names were arranged in row-and-column order.

Bruce D. McCurdy
Derwood, Maryland

Actually, the F3 key can be used in almost any situation in which 1-2-3 *allows you to highlight a range. This includes the following commands:*

```
/Worksheet Insert (Column or Row)
/Worksheet Delete (Column or Row)
/Renge (Format, Label, Erese, Name,
    Juatify, Protect, Unprotect,
    Input, Velue, Trenspose)
/Print (Printer or File) Renge
/Graph (X, A, B, C, D, E, end F)
/Dete (Fill, Teble, Sort, Query,
    Distribution, Matrix, Parae)
```

Unfortunately, however, you cannot use the key to reveal a list of range names while you are entering a function into a worksheet.

LOADING SUPERCALC4

Like many users of *SuperCalc4*, I got tired of having to press a key to enter *SuperCalc* after loading it. To eliminate this irritating delay, I created the simple, two-line macro shown in Figure 2.

After making these two entries into a new worksheet, I then pressed the Home key to return the cell pointer to cell A1; issued the /Macro Write command; typed the name AUTOEXEC.XQT; pressed Enter, the period key, and the Down Arrow key to highlight cells A1:A2; and finally pressed Enter again. After saving the macro in this way, I issued the /Quit Yes command to quit from *SuperCalc*.

	A	B	C
1	/L		
2	{Name}		

Figure 2: *This simple macro eliminates the need to press a key to complete the loading of* SuperCalc4.

Since I named this macro AUTOEXEC.XQT, it executes automatically whenever I load *SuperCalc4*. The fact that there is an auto-executing macro eliminates the need to press any key to enter *SuperCalc*. The commands in the macro issue the /Load command, then press the F3 key to reveal a list of the files in the current directory.

Joe Janules
Utica, Michigan

This is a simple but useful tip for all users of SuperCalc4.

INTERPOLATING WITH @VLOOKUP

The @VLOOKUP and @HLOOKUP functions in *1-2-3* return a result that corresponds to one of the values in the key column or row of the lookup table. When the entries in the key column of a lookup table are values and the key value falls between two of the values in the key column, *1-2-3* returns the result that corresponds to the lower value. For example, if the key value of an @VLOOKUP function is 3.5 and the key column contains only the values 2, 3, 4, and 5, *1-2-3* returns the result that corresponds to the value 3. The function would therefore return the same value for key values of 3.25, 3.75, and so forth.

I often need to look up values that fall between two discrete values in the key column. Instead of returning the result that corresponds to one of the discrete values in the key column, however, I need to make *1-2-3* interpolate the result of evaluating the @VLOOKUP function for each of the two values. Thus, if the key value is 3.5 and the key column contains the values 2, 3, 4, and 5, I want *1-2-3* to calculate and return a value midway between those that correspond to the values 3 and 4.

To do this, I use a formula like the one in cell B14 of the worksheet shown in Figure 3. This formula is based on the following equation:

```
Y=((Y1-Y0)/(X1-X0))*(X-X0)+Y0
```

in which X0 is the value that the @VLOOKUP function locates in the key column, Y0 is the result of that function, X1 is the next value in the key column, Y1 is the result that corresponds to that value, and X is the key value for which you want *1-2-3* to calculate the result, Y.

The function in cell B14 of the worksheet interpolates the value of Y (a value in the second column of the table) corresponding to the value of X stored in the cell named VALUE (B13). The discrete values of X are situated in the first column of the lookup table.

■ Although you will most commonly use F3 with the Goto key and the /Range Name Create commands, you can use it in conjunction with a variety of other commands.

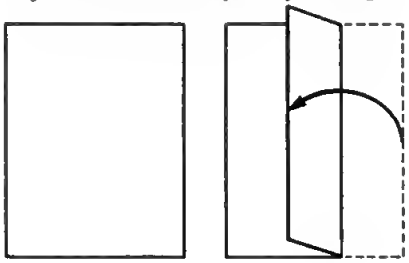
Before using this formula, you must copy the values from cells A4..B11 (the second through ninth XY pairs) into cells C3..D10, which originally were blank. This places each pair of XY pairs on the

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■ SPREADSHEET CLINIC

```
        A          B          C          D
1        XO         Y0         X1         Y1
2     ------     ------     ------     ------
3      1.00       0.000      1.50       0.176
4      1.50       0.176      2.00       0.301
5      2.00       0.301      3.00       0.477
6      3.00       0.477      4.00       0.602
7      4.00       0.602      5.00       0.699
8      5.00       0.699      6.50       0.813
9      6.50       0.813      8.00       0.903
10     8.00       0.903     10.00       1.000
11    10.00       1.000
12
13   VALUE         3.75
14   RESULT     0.57075

     Cell B14 contains the formula:

     (@VLOOKUP(VALUE,TABLE,3)
          -@VLOOKUP(VALUE,TABLE,1))/
               (@VLOOKUP(VALUE,TABLE,2)
                    -@VLOOKUP(VALUE,TABLE,0))
                         *(VALUE-@VLOOKUP(VALUE,TABLE,0))
                              +@VLOOKUP(VALUE,TABLE,1)
```

Figure 3: *The formula in cell B14 extrapolates the result of looking up a value that falls between any two of the values in the key column.*

same row of the table. After doing this, you should assign the range name TABLE to cells A3..D11.

To explain how this formula works, suppose that VALUE contains the value 3.75, as it does in Figure 3. This value falls between the fourth and fifth values in the first column of the table (3 and 4, respectively). Consequently, the result will be a value between the fourth and fifth values in the second column (.477 and .602).

The first part of the formula returns the value .602 from cell D6—the value of Y that corresponds to an X value of 4. The second part returns the value .477 from cell B6—the value of Y that corresponds to an X value of 3. The difference between these two values is .125.

The third part of the formula returns the value 4 from cell C6—the discrete value of X immediately above the one you are looking up. The fourth part of this formula returns the value 3 from cell A6—the discrete value of X immediately below the one you are looking up. The difference between these two values is 1. Dividing .125 by 1 returns the value .125.

The fifth part of this formula returns the value 3.75−3=.75—the difference between the value of X you are looking up and the discrete value of X that precedes it. Multiplying this value by .125 produces .09375. The final part of this formula returns the value .477 from cell B6—the value of Y that corresponds to an X value of 3. Adding this value to .09375 produces .57075, which is the calculated value of Y that corresponds to an X value of 3.75.

David E. Haralson
North Richland Hills, Texas

Mr. Haralson's technique is complex but invaluable to anyone who needs to look up values that fall between two of the values in the key column of a lookup table.

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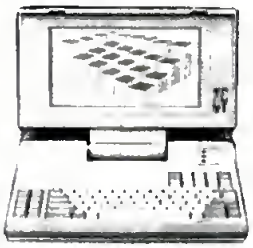
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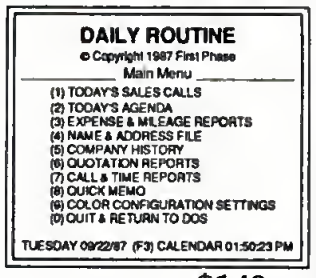
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■ PAUL SOMERSON



USER-TO-USER

Somerson's final column and a dozen COM programs to handle everything on your PC, from colors to cursors to reboots to reading ROMs.

Well, this is it. A few years ago Bill Machrone gave me the chance to turn *PC Magazine*'s back pages into the best, most useful how-to section in existence. With the help of experts like Charles Petzold, Michael Mefford, Jeff Prosise, Robert Hummel, Ray Duncan, Jared Taylor, Craig Stark, Neil Rubenking, Ethan Winer, the Cobb brothers, and the thousands of readers who sent us their favorite tips and tricks, we've succeeded. I thank you all.

Now Ziff-Davis has given me a hot opportunity—to design and edit a sizzling new magazine named *PC Computing*, which we're calling "America's Computer Magazine." While *PC Magazine* will continue to publish its incredibly popular productivity columns, *PC Computing* will provide lots more ingenious ways to stomp on your computer's accelerator. And it will bring you up to speed quickly if you need a little extra help. These two magazines will be an unbeatable combination for users who are serious about truly mastering their systems.

For as long as I can remember, readers have been flooding my mailbox with letters asking us to take the very best tips from the past few years of *PC Magazine*'s technical columns and cram them all into one place. The wait is over. I've spent the last half-year gathering, editing, and updating *PC Magazine*'s many sensational technical tricks, secrets, and advanced techniques into a massive book called *PC Magazine DOS Power Tools*, published in May by Bantam. It's packed with information from these pages, and it comes with a disk that contains hundreds of the small but powerful programs we've published over the years—as well as many new ones.

Below are a dozen small programs from the book that haven't yet been published in *PC Magazine*. Use a pure-ASCII word processor to type the individual scripts in Figure 1. Then, redirect the appropriate .SCR version of each one into DEBUG with a command like

```
DEBUG < BLANKINS.SCR
```

Bill Machrone and I have watched this section grow into a national institution. Readers have downloaded an average of over 15,000 of its programs from our PC-IRS each day, 7 days a week. And we've shown hundreds of thousands of readers how to work better, faster, and smarter. I'll miss it. But you'll remain in good hands, with tech wiz Robert Hummel running the overall section (under the able direction of executive editor Gus Venditto) and ace Sal Ricciardi and others dishing out User-to-User advice.

■ Many sensational technical tricks, secrets, and advanced techniques are gathered in a massive book: *PC Magazine DOS Power Tools*.

1. **BLANKINS.COM**—Blanks the screen temporarily by turning the colors to black on black without changing the on-screen text. Pressing the Ins key restores the original colors and text.

Format:

```
[d:][path]BLANKINS
```

You can change the key that reactivates things by patching address 12C. To change the restorative key to Shift-Tab and end up with a copy of the program called BLNKSHTB.COM, you'd type

```
DEBUG BLANKINS.COM
E 12C 0F
N BLNKSHTB.COM
W
Q
```

When you press Ins (or any other key you've used to restore the screen), BLANKINS.COM will reset the colors to the ones in effect at the cursor when you started the program. If you use lots of different colors on the screen at once, this won't restore them all.

BLANKINS.COM is hard-wired for 80 by 25 screens only. It restores the color by filling every other byte in video memory with the desired attribute value.

2. **BORDER.COM**—Sets border color from the command line on CGA or CGA-compatible screens.

Format:

```
[d:][path]BORDER n
```

where *n* corresponds to the hex value of a

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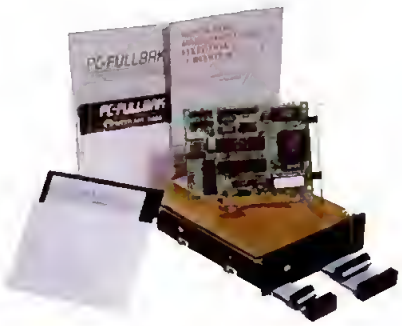
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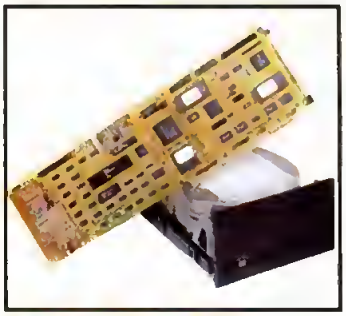
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■ USER-TO-USER

border color from 0 through F.

IBM doesn't support border colors on any systems other than the CGA. However, if you are using a CGA you may choose any border color from 0 (black) to F (bright white). Note: This will change the screen colors rather than the border in BASIC graphics screens 1 and 2. To change the low-resolution background color to red, for instance, load BASIC, type SCREEN 1, and then enter

```
SHELL "BORDER 4
```

3. **COLOR.COM**—Sets foreground and background colors from the command line and clears the screen to those colors. The COLOR2.COM program below sets colors but doesn't clear the screen.

Format:

```
[d:][path]COLOR bf
```

where *b* is a background color and *f* is a foreground color.

Enter two different hex numbers from 0 through F, where *f* is the foreground and *b* is the background. If you enter anything else, COLOR.COM will print instructions on how to use it.

You may enter alphabetical hex digits in either uppercase or lowercase. Digits may be separated by spaces, commas, or any other characters, or entered next to each other. Entering a background higher than 7 will make the foreground blink.

4. **COLOR2.COM**—Sets foreground and background colors from the command line but leaves the contents of the screen intact.

Format:

```
[d:][path]COLOR2 bf
```

where *b* is a background color and *f* is a foreground color.

While the above COLOR.COM program clears the screen when it sets the colors, it doesn't disturb the screen contents. It does so by writing to the attribute bytes in video memory and assumes an 80 by 25 screen at segment B800h.

As with COLOR.COM, you must enter two different hex numbers from 0 through

```
N BLANKINS.COM
E 100 B4 0F CD 10 3C 07 74 05 B8 00 B8 BB 03 B8 00 B0
E 110 8E C0 33 FF B4 00 CD 10 58 B4 03 CD 10 33 FF E8
E 120 10 00 33 E4 CD 16 3C 00 75 F6 00 FC 52 75 F3 58
E 130 00 E7 BB 00 00 B9 D0 07 00 7C 01 03 C6 02 49 05
E 140 C9 75 F5 B4 02 33 FF CD 10 C3
RCX
4A
W
Q


N BORDER.CDM
E 100 BB 00 00 8B 0C 32 ED E3 31 FB C9 46 46 0A 1C 00
E 110 FB 30 72 1B 00 FB 39 76 10 00 E3 DF 00 FB 41 72
E 120 0E 00 FE 44 77 09 00 BB 07 00 EB 30 EB 06 90 E2
E 130 0B EB 07 90 B4 0B 32 FF CD 10 CD 20
RCX
3C
W
Q


N COLOR.COM
E 100 B7 FF BE 00 00 0B 0C 32 ED E3 4A 44 46 0A 04 3C
E 110 30 72 19 3C 39 76 0C 24 0F 3C 41 72 0F 3C 46 77
E 120 0B 2C 07 2C 30 00 FF FF 72 07 0A F0 E2 0B Ee 25
E 130 90 0A 08 3A FB 74 1B B1 04 02 B7 0A FB e0 00 04
E 140 B9 00 00 BA 4F 10 CD 10 B4 0F C0 10 B4 02 33 02
B 150 C0 10 EB 00 90 BA 5E 01 B4 09 CD 21 CD 20
E 15E 0D 0A ' Enter two different bex foreground/background'
E 18E 20 'colore between 0-F (eg 71 or 4E)' 0D 0A 24
RCE
B2
W
Q


N COLOR2.CDM
B 100 B7 FF BE 00 00 0e 0C 32 ED B3 4e 44 44 0A 04 3C
E 110 30 72 19 3C 39 76 0C 24 0F 3C 41 72 0F 3c 46 77
B 120 0B 2C 07 2C 30 00 FF FF 72 07 0A F0 E2 DE BB 26
E 130 90 0A 08 3A FE 74 1F B1 04 D2 E7 0A FB B0 00 B0
E 140 0E 08 BE 00 00 B9 08 07 00 7C 01 03 C6 02 49 05
E 150 C9 75 F5 Be 00 90 BA 5F 01 B4 09 CD 21 CD 20
E 15F 0D 0A 20 'Enter two different hex foreground/beckground'
B 18F 20 'colors between 0-F (eg 71 or 4E)' 0o 0A 24
RCE
B3
W
Q
```

```
N CDLORPIE.COM
E 100 B4 09 BA 05 01 CD 21 B7 00 B4 08 CO 10 00 B6 52
E 110 B4 0F CD 10 3C 07 74 05 B8 00 B0 EB 03 B0 00 B0
E 120 0E D0 E0 4B 00 30 E4 CO 16 3C 0o 75 03 5A BB 54
E 130 3C 1B 74 3B 3C 00 75 ED 00 FC 40 75 09 00 FE 7F
B 140 74 B3 FE C6 EB DC 00 FC 50 75 09 00 FE 00 74 D5
E 150 FE CB EB CE 00 FC 4B 75 0A 00 FE 10 72 C7 00 BE
B 160 10 EB BF 00 FC 4D 75 BD 00 FE 6F 77 B0 00 C6 10
E 170 EB B0 5A BE 00 00 B9 D0 07 00 74 01 03 C6 02 49
E 180 05 C9 75 F5 C3
E 185 'Prees ',10,' and ',19,' to change foreground.',0D,0A
E 1AA 'Freee ',1B,' and ',1A,' to change background.',0D,0A
E 1CF 'Then press Enter to eeve colore and quit.',0D,0A
B 1FA '(Or press Bac to abort and restore colors.)',0O,0A,24
RCE
128
W
Q


N CDLRSHOW.COM
E 100 B0 01 50 30 FF B4 02 31 D2 CD 10 58 00 C3 00 C2
E 110 B1 04 02 C2 30 C2 75 02 FE CB B4 09 B9 D0 07 CD
B 120 10 50 B4 07 CD 21 3C 00 75 2C B4 07 CD 21 3C 50
E 130 75 10 50 00 FB 01 75 05 B0 7F 50 EB C6 FE C0 50
E 140 BB C1 3C 40 75 DC 58 00 FB 7F 75 05 B0 01 50 EB
B 150 B2 FB C0 50 BB AD 3C 1B 74 10 00 C2 58 04 C2 3C
E 140 21 72 BF 3C 7E 77 BB 50 EB 99 58 CD 20
RCX
40
W
Q


N CURSOR.COM
B 100 B7 FF BB 00 00 0B 0C 30 BO B3 31 46 46 0A 04 3C
E 110 30 72 1B 3C 39 74 0C 24 0F 3C 41 72 11 3C 46 77
E 120 0D 2C 07 2C 30 00 FF FF 72 00 00 C3 00 0F E2 DC
B 130 EB 0A 00 C1 00 DD B4 01 CD 10 EB 07 BA 45 01 B4
E 140 09 CD 21 CD 20
B 145 0D 0A 'Eoter a two-digit hex number where the left'
E 172 20 0D 0A 'digit is the cureor start line and the right'
E 1A1 20 0O 0A 'digit is the stop line, eg 47 or BC.' 0O 0A 24
RCE
CB
W
Q


N CURSOR2.COM
E 100 30 FF B4 03 CD 10 51 B8 00 0C CD 21 3C 1B 74 32
B 110 3C 0D 74 35 3C 00 75 EF B4 00 CD 21 3C 40 74 0E
B 120 3C 50 74 0B 3C 4B 74 0B 3C 4O 74 0E EB D9 FE C5
```

(continues)

Figure 1: *DEBUG scripts for the programs described in the accompanying text. Use a pure-ASCII word processor to type them in. Then, redirect the appropriate .SCR version of each one into DEBUG with a command such as: DEBUG < BLANKINS.SCR*

■ USER-TO-USER

```
E 130 BE 0A FE CD EB 06 FE C1 EB 02 FE C8 E4 01 CD 10
E 140 EB C5 58 E4 01 CD 10 EB 0E 00 CA 58 30 CA 75 07
E 150 E4 00 BA 58 01 CD 21 C3
E 158 'Press ',1B,' and ',1B,' to change start line.',0D,0A
E 17D 'Press ',1B,' and ',1A,' to change end line.',0D,0A
E 1A6 'Then press Enter to save any changes',0D,0A
E 1C6 '(or Esc to quit without changing).'0D,0A,24
RCX
EB
W
Q


W PAGE.COM
E 100 B4 0F CD 10 3C 03 75 51 BE 00 00 8E 0C 32 ED E3
E 110 17 44 44 8A 04 3C 3F 74 2E 3C 30 72 00 3C 33 77
E 120 05 2C 30 EB 0D 00 E2 BA BA 44 01 E4 00 CD 21 EB
E 130 28 00 B4 05 CD 10 B4 03 CD 10 00 EE 01 E4 02 CD
E 140 10 EB 14 00 BA 5E 01 E4 00 CD 21 B4 0F 8A D7 00
E 150 C2 30 E4 02 CD 21 EB 01 00 CD 20
E 15E 'Page is $'
E 144 'Enter page 0-3 or ? for current.page$'
RCX
00
W
Q


N PAGECLS.COM
E 100 B4 0F CD 10 B4 00 CD 10 53 8A FC B8 00 04 B9 00
E 110 00 BA 4F 18 CD 10 E4 02 5E 33 D2 CD 10 CD 20
RCE
1F
W
Q


N REBOOT.COM
E 100 B4 00 BA 31 01 CD 21 B8 00 0C CD 21 3C 1E 74 20
E 110 24 DF 3C 43 74 00 3C 57 75 ED EE 34 12 EB 03 BE
E 120 7F 7F E8 40 00 8E D8 00 1E 72 00 BA 00 00 FF FF C3
E 131 'Warm or Cold boot (W/C)? -- or Esc to abort:  $'
RCE
40
W
Q


W ROMINFO.COM
E 100 E4 00 BA 04 01 CD 21 1E BA 00 F0 8E DA B9 00 00
E 110 EB F5 FF 8A 17 B4 02 CD 21 43 E2 F7 1F B4 00 BA
E 120 A0 01 CD 21 1E BA 00 F0 8E DA E9 0E 00 EE 00 E9
E 130 8A 17 B4 02 CD 21 43 E2 F7 1F B4 00 BA CF 01 CD
E 140 21 1E BA 00 F0 8E DA EE FE FF 8A 17 00 D6 00 E2
E 150 F0 81 04 D2 EA 00 E2 0F 00 C2 37 00 FA 41 7D 03
E 160 00 BA 07 E4 02 CD 21 00 E6 0F 00 C6 37 00 FE 41
E 170 7D 03 00 EE 07 00 F2 E4 02 CD 21 1F B4 00 BA F3
E 180 01 CD 21 C3
E 184 0D 0A 'ROM date at address F000:FFF5 is $'
E 1A8 2E 0D 0A '(C) notice at address F000:E005 is $'
E 1CF 2E 0D 0A 'ID Byte at address F000:FFFE is $'
E 1F3 2E 0D 0A 24
RCX
F7
W
Q
```

(Figure 1 ends)

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CIRCLE 725 ON READER SERVICE CARD

F, where *f* is the foreground and *b* is the background. Enter anything else and COLOR2.COM will simply print instructions on how to use it.

5. **COLORPIK.COM**—Lets you change screen colors by pressing arrow keys.

Format:

```
[d:][path]COLORPIK
```

Pressing the Left and Right Arrow keys cycles through all available colors. Pressing the Up and Down Arrow keys cycles through the eight available background colors—without clearing the screen.

When you see the color combination you want, just press the Enter key to lock it in and exit.

If you want to abort the process and restore your original colors, press Esc. Since the program lets you use the same foreground and background colors, which makes any text on the screen invisible, pressing Esc will put everything back to normal. This program is hard-wired for an 80 by 25 screen.

6. **COLRSHOW.COM**—Shows all possible different foreground-background color combinations on color systems.

Format:

```
[d:][path]COLRSHOW
```

With 16 possible foreground colors and eight possible background colors, you can mix and match 128 color combinations. COLRSHOW.COM uses BIOS INT 10 service 9 to show them all. (Actually, it shows only 120, since it skips any combinations that have the same background and foreground colors.)

Since it needs to print something in the foreground, it fills the entire screen with the ASCII character that happens to have the same value as the color attribute shown.

When you first run it, COLRSHOW will fill the screen with ASCII character 01 smiling faces. Since the color attribute that has the same value as the character shown—01—is blue (color 1) on black (color 0), the screenful of faces will appear in blue on black.

You can press the Up Arrow Key repeatedly to increase the value of the character shown (as well as the color it's shown in), or the Down Arrow key to decrease this value. Or you can type in any letter other than a space to fill the screen with that character in the color that matches its ASCII value. (Typing in a space wouldn't show anything other than a green background.)

For instance, typing a "t" will fill the screen with red lowercase "t" characters on a white background, since the hex value of "t" is 74, and the color attribute 74 is red (4) on white (7).

Pressing the Up Arrow repeatedly will fill the screen with blue ASCII 01 charac-

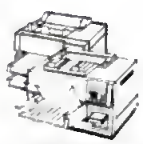
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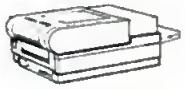

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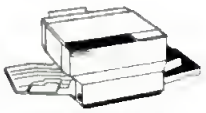

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■ USER-TO-USER

ters, then green ASCII 02 characters, then cyan ASCII 03 characters, etc. Pressing the Down Arrow repeatedly will display these characters in descending order. If you reach the top or bottom of the list of possible values, the program will let you cycle through them all again.

Pressing Esc will quit. The screen colors you last selected will remain in effect.

7. **CURSOR.COM**—Sets cursor shape.

Format:

```
[d:][path]CURSOR ss ee
```

where *s* is the cursor-starting scan line and *e* is the cursor-ending scan line, in hex notation.

A monochrome display uses 14 scan lines for each character, 0–13. A CGA (and, for all practical purposes, an EGA) uses 8 scan lines, 0–7.

While the EGA character box has 14 lines, most programs designed to work on color systems assume an 8-line box. Using the default color scan lines 6 and 7 on an EGA would normally result in a cursor blinking somewhere in the middle of the character box. The EGA BIOS's built-in cursor emulation logic translates the normal cursor size into something more appropriate for a 14-scan-line character.

The CURSOR.COM number to enter for the default monochrome cursor is BC (starting at scan line hex 0B, or decimal 11, and ending at scan line hex 0C or decimal 12). The number for the default CGA cursor is 67 (starting at scan line 6 and ending at scan line 7).

You can change the size and shape of the cursor by specifying new starting and ending values. A low starting line and a high ending line yields a block cursor. You can also end up with unusual shapes by making the starting line higher than the ending line. Entering the default values will bring the cursor back to normal.

8. **CURSOR2.COM**—Lets you create any cursor shape you want interactively by pressing the arrow keys.

Format:

```
[d:][path]CURSOR2
```

CURSOR2.COM gives you an easy way to see what cursor shapes are possible, with the option of changing your current cursor.

When you first load the program, the current cursor drops down one line. Pressing the arrow keys will change the cursor shape as follows:

Up Arrow	Increase starting line
Down Arrow	Decrease starting line
Left Arrow	Increase ending line
Right Arrow	Decrease ending line

Each time you press an arrow key, the value changes by 1 in the direction indicated. If you like what you see, you can press the Enter key, which will lock in the currently displayed value and then exit.

However, since many values will either make your cursor disappear entirely or will produce something that you can't possibly use, you may press Esc to abort the process and the program will restore your original cursor.

■ Warm boots and cold boots are almost identical, except a cold boot performs an additional power-on-self-test as if you had turned the main power switch off and on.

If you load CURSOR2 and then press Enter without making any changes, the program will display instructions.

9. **PAGE.COM**—Switches among text pages 0 and 3 on a color system and identifies the current video page.

Format:

```
[d:][path]PAGE n | ?
```

where *n* is an 80 by 25 text mode video page number, and ? is a parameter that reports the current page being worked on. You may use only one of these variables at any given time.

Entering a page number from 0 to 3 will make that video page active. Entering a ? will display the current page. The BIOS default page (the one most users commonly work in) is page 0. Entering a page number out of range won't do anything.

A limitation is that this will work only on color systems and only in the 80 by 25 color text mode. You can use screen pages to store information—such as directory listings—and treat these other pages almost as text windows.

10. **PAGECLS.COM**—Clears any 80 by 25 screen to the existing screen colors and on the current video page.

Format:

```
[d:][path]PAGECLS
```

Most CLS utilities assume you want to clear the screen to preset colors and on video page 0. This program looks at the existing colors and maintains those colors when it clears the screen, and it will clear whatever page happens to be active without disturbing any other video pages.

11. **REBOOT.COM**—Lets you select a warm boot or a cold boot, or abort the rebooting process.

Format:

```
[d:][path]REBOOT
```

This is a very simple program that prints a short message on-screen and gives you three options. You can:

1. Press C or c for a cold boot
2. Press W or w for a warm boot
3. Press Esc to abort and return to DOS

The program ignores any other keypresses.

Warm boots and cold boots are almost identical, except that a cold boot performs an additional power-on-self-test (POST) as if you had turned the main power switch off and on, while a warm boot skips these tests as if you had pressed Ctrl-Alt-Del.

When a PC boots, its BIOS checks a flag word (2 bytes) at location 40:72. If the value of the flag is hex 1234, BIOS does a warm boot. If the flag is not 1234, BIOS does a cold boot. Once you boot up, it puts a 1234 there so subsequent Ctrl-Alt-Del warm boots can skip the POST.

If you use DEBUG to look at addresses 40:72 and 40:73, you'll see 34 12 rather than 12 34 since the PC stores words in "backwords" order. The high-order byte (12) goes into the higher memory address (40:73), while the low-order byte (34) goes into the lower memory address (40:72). Despite this, the word takes the lower memory address as its own.

IBM Hardware Releases

ROM date	ID	System
04/24/81	FF	IBM PC (collector's item)
10/19/81	FF	IBM PC (bugs fixed)
08/16/82	FE	IBM PC-XT (first one)
10/27/82	FF	IBM PC handling hard disk and 640K
11/08/82	FE	IBM Portable PC, XT
06/01/83	FD	IBM PC*jr*
01/10/84	FC	IBM PC AT
06/10/85	FC	IBM PC AT (rev 1)
09/13/85	F9	IBM PC Convertible
11/15/85	FC	IBM PC AT with speed governor, 30MB hard disk, Enhanced keyboard (submodel 1)
01/10/86	FB	IBM PC-XT (rev 1)
04/21/86	FC	IBM PC-XT Model 286 (submodel 2)
05/09/86	FB	IBM PC-XT (rev 2)
09/02/86	FA	IBM PS/2 Model 30
02/13/87	FC	IBM PS/2 Model 50 (submodel 4)
02/13/87	FC	IBM PS/2 Model 60 (submodel 5)
03/30/87	F8	IBM PS/2 Model 80 (16 MHz)
10/07/87	F8	IBM PS/2 Model 80 (20 MHz)

The ROM date is at address F000:FFF5. The copyright notice is at address F000:E005 and the ID byte is at address F000:FFFE.

12. **ROMINFO.COM**—Reports the date, copyright notice, and ID Byte information embedded in most ROM BIOS chips.

Format:

```
[d:][path]ROMINFO
```

IBM changes the BIOS with each new system. Some older BIOS chips had serious problems. For instance, the BIOS in an original PC prevents it from booting off a hard disk. And most systems have gone through several revisions. (See the table "IBM Hardware Releases.")

Fortunately, IBM socketed its ROM chips to let you upgrade them. Unfortunately, it also stopped selling some of the upgrade ROMs. If you're trying to install a hot new piece of hardware on an old system and it doesn't work, one reason could be a ROM that needs upgrading.

You can use ROMINFO.COM to sniff out the date (which IBM calls the "release marker"), the copyright notice, and the machine ID byte. If it tells you that you're using an older ROM, you might be able to have your dealer switch ROM chips with someone who doesn't need the newer one.

The ID Byte is a single value at the very top of memory that some software uses to determine the kind of hardware it's dealing with.

This program looks at three specific ROM addresses. The ID byte should be at the same place in most systems, but the copyright notice and perhaps even the ROM "release marker" may not. If not, the program will print whatever characters happen to be at those addresses and you may end up seeing garbage on non-IBM systems.

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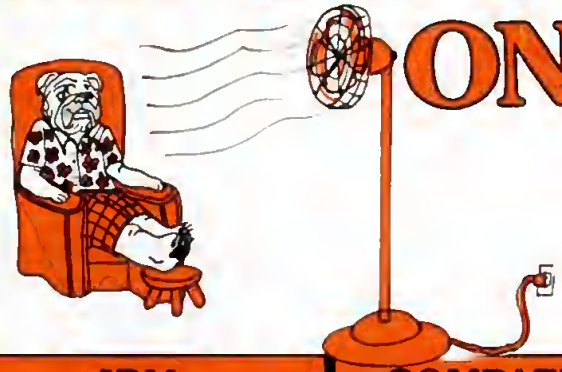
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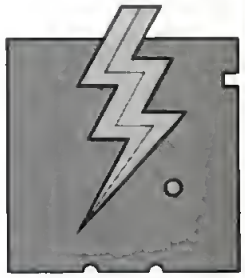
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■ EDITED BY CRAIG L. STARK



POWER USER

Building Function Key menus from INKEY() values; archiving tips for MCI mail; updating WordPerfect macros; toggling macros in Word; using number keys for SuperKey macros.

FORCING MACRO UPDATES

When you have used a *WordPerfect* macro once during a session, it remains in RAM. This speeds its execution the next time you use it.

However, if you modify a macro with *WordPerfect* Library's Macro Editor and save the new version to disk, invoking the macro via the usual keystrokes gets the old macro, which is still stored in RAM. Exiting *WordPerfect* will clear macros from RAM, but there is an easier way that carries a built-in bonus with it.

By preceding the macro name with a path—even the *current* path—you can force *WordPerfect* to retrieve the file from disk rather than run it from RAM. Thus, if you have a macro called FORMAT.MAC in the directory WP\LTR, you would enter "\WP\LTR\FORMAT" at the "Macro:" prompt. You can also run Alt-key macros this way, e.g., "\WP\LTR\ALTF".

The bonus to all this is that you can run a macro from a noncurrent directory without copying it. Experiment has shown that, once imported with the help of a path, such a "foreign" macro stays available in RAM for the duration of the current session.

Jordan V. Hodgson
Manhattan Beach, California

You can also save macros to a noncurrent directory. This will allow you, for example, to put a macro into WordPerfect*'s own directory. Any macro that resides in the same directory as the* WP *program can be called from any subdirectory. Suppose your* WP *program is in the directory "C:\WP". To create a macro called "FORMAT" and store it in that directory, just enter "C:\WP\FORMAT" at the "Define Macro:" prompt. You can do the same with Alt-key macros—e.g., "C:\WP\ALTF".*—Neil J. Rubenking

INKEY() VALUES CHART

The INKEY() function in *dBASE III Plus* can be extremely useful in constructing menus (up to 40 choices are available), but only one INKEY() value for the Function Keys is listed in the *dBASE* manual.

The "INKEY() Reference Guide" below provides a convenient reference chart. *Quicksilver* returns the same values as *dBASE III Plus*. *FoxBase* 2.0 also returns the same values as *dBASE* with the odd exception that Ctrl-h returns 127.

Glenn Alcott
Elmhurst, New York

If you use Function Key menus, this chart is worth saving in a handy place. INKEY() values returned by Versions 1.0 and 1.1 of dBASE III Plus *are identical; the INKEY() function is not available in earlier* dBASE *releases.*

The INKEY() values of characters and numbers plus the control key jump all over the place. If you need to determine these

INKEY() Reference Guide

Key	Key combination		*dBASE*	*Clipper*
F1			28	28
F2 to F9			-1 to -9	-1 to -9
	Shift	F1 to F9	84 to 93	-10 to -19
	Shift-Ctrl	F1 to F9	84 to 93	-10 to -19
	Ctrl	F1 to F9	94 to 103	-20 to -29
	Alt	F1 to F9	104 to 113	-30 to -39
	Shift-Alt	F1 to F9	104 to 113	-30 to -39
	Ctrl-Alt	F1 to F9	104 to 113	-30 to -39
	Shift-Ctrl-Alt	F1 to F9	104 to 113	-30 to -39
a to z			65 to 90	65 to 90
A to Z			97 to 122	97 to 122
	Ctrl	a to z	1 to 26	1 to 26
	Ctrl	A to Z	1 to 26	1 to 26

A list of returned INKEY() values in *dBASE* and *Clipper*.

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■ POWER USER

values, use Steve Westwood's program, presented in this column in the August 1987 issue.—Brad Stark

MORE KEYS FOR SUPERKEY

Few if any programs use the top row of number keys in conjunction with Ctrl or Alt. This makes these keys the best choice for *SuperKey* macros that you want to keep loaded at all times, such as those you would use for working with DOS.

Having *SuperKey* macros for DOS commands saves you from entering such awkward keyboard sequences as

```
PROMPT $e[1m$p$g$e[0m)
```

It also saves space compared with the alternative of creating a group of very short batch files, each of which eats up 2K on your hard disk.

Figure 1 shows some useful *SuperKey* DOS macros that use the number keys, plus Alt-UP (for DIR A:) and Alt-DN (for DIR B:). Notice the Alt-1 display macro shows a help menu at the bottom of the screen. This provides an alternative to *SuperKey*'s Alt-PrtSc macro display that lets you keep track of which key does what.

You create the macros with a text editor, adding a <BEGDEF> before each one—except for the display macro, <Alt1>, which should begin, as shown, with <BEGDISP>. Also add an <END DEF> after each one, including the display macro.

When creating these macros, I found that you cannot program the Ctrl-2 key. It will work when you first program it, but the next time you load the file, the macro won't be there. I've also found that after I invoke the Alt-1 Help macro, it sometimes refuses to go away when I hit the Esc key. However, by hitting the Alt key once and then the Esc key, you can clear it off your screen.

Joe Cygman
Montreal, Quebec
Canada

The only addition I'd suggest is to add the <TRANSP> *command to the display macro. To do this, simply place* <TRANSP> *between the period after the 3 and the first* <TITLE> *in Figure 1. Then when you call up the menu you can type the command immediately, without having to clear the menu from your screen first.*

Using SuperKey, *Version 1.16A, I was unable to reproduce either problem that Mr. Cygman mentioned. The solution may be to upgrade to the most current version of the program.*—M. David Stone

ARCHIVING MCI MAIL MESSAGES

Lotus Express is invaluable for many MCI Mail users, but it provides no way to handle batches of messages for archiving. If you clear out a megabyte of accumulated files on your hard disk each month by copying each one individually, it becomes a nightmare to try to find any specific message later. Fortunately, there is a simple solution.

Assume that the files you want to archive in the month of June are in your SENT.FLD *Express* folder. Put a floppy in drive A: and type

```
COPY NULL+SENT.FLD\*.LTR A:SENTJUNE.EXP
```

Since *Express* stores all messages with

```
<AltUP><TITLE>dir e:<TITLE>dir a:
<AltDN><TITLE>dir b:<TITLE>dir b:<ENTER>
<BEGDISP><Alt1>  1 22 78  3.<TITLE>Help<TITLE>
    1      2      3      4      5      6      7      8      9      0
c  copy         list  delbak  e: b:  diskcopy  ..... ....... ...... ......
e  HELP  exit  type  chkdsk  b: a:  format A  ..... ....... ...... prompt
<Alt2>exit<ENTER>
<Alt3>type
<Alt4>chkdsk
<Alt5>b: e:<ENTER>
<Alt6>format e:<ENTER>
<Alt0>prompt $e[1m$p$g$e[0m<ENTER>
<Ctrl1>copy
<Ctrl3>list
<Ctrl4>del *.bak<ENTER>
<Ctrl5>e: b:<ENTER>
<Ctrl6>diskcopy a: b:<ENTER>
```

Figure 1: *A set of* SuperKey *DOS macros that use the regular keyboard number keys.*

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Btrieve is multi-lingual also. It includes more than 20 language interfaces (including C, BASIC, PASCAL, FORTRAN). However if it turns out that you are using something a little unusual, worry not. The manual includes a chapter on how to write a language interface to Btrieve.

Btrieve's vital statistics are equally impressive. Files may have up to 24 indexes, fixed record length to 4090 characters, variable length to 64K, indexes to 255 characters, files of 4 billion bytes. Network support includes Novell, 3-COM, IBM PC NET, Software Link's Multilink and many others.

XQL is a relational database management system designed especially for programmers. Imagine being able to access your database with the ease of SQL (Structured Query Language) statements and still having the power to process that data right down to the byte level.

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The XQL system works in tandem with Btrieve and has an equally powerful chassis. No limit on the number of records per file. Max. file size is 4 gigabytes, Max. record size equals 4K, Max. indexes per file is 24. The one version works for single or multiuser systems, DOS Ver 3.0 or greater. All languages are supported.

Xtrieve is the final ingredient in the Novell programming recipe. It is a menu driven, data retrieval system, that allows you to quickly find information and display reports. System developers can easily customize Xtrieve to display command menus, help files, and error messages in the English spoken by the customer. Xtrieve screens then gives menu choices that users can quickly recognize, making Xtrieve an easy product to use and understand.

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an LTR extension, this command concatenates all the messages into a single file on your A: drive. (The NULL is needed to make concatenation work with the wildcard.) If you want to keep the attachments as well, you'll have to save them separately, using the *Express* Filing Save Attachment command. Because the messages are all stored in straight ASCII format, you can now call up the SENTJUNE.EXP archive file in your favorite word processor and use its search command to find a desired message.

You'll still have to go back into *Express* and delcte the stored messages one at a time, but the Alt-D speed key advances you rapidly from file to file in a folder, making the job quick and easy.

Alfred Poor
Southington, Connecticut

■ The Yes/No nature of many menu choices in *Word* lets you create macros that easily toggle between these choices.

This approach ta archiving the messages works even better if yau use it with a program like ZyIndex. *Such pragrams index all af your archive files aud let yau search through the index when yau need to find a specific message. The program will then tell you which archive disk to put in yaur drive, and it will find and display all matching messages far you.*

An alternate approach to archiving is alsa worth cansidering. Express *itself maintains an index (it uses the extension S13) for each of its mail folders. The index file for SENT.FLD wauld be SENT.S13. Ratlier than cancatenate the messages in a single file, you can simply copy the SENT.S13 file ta the root directory of your archive disk, create a SENT.FLD subdirectary an the disk, and use the cammand*

```
COPY d:\MAILSYS\SENT.FLD\*.* A:\SENT.FLD
```

This will copy all messages and attachments ta the archive disk. To browse through your archived messages, yau anly have to put the disk in the drive, call up the Express *cammunicatians manager, and change the mail falder directary fram* d:*MAILSYS ta A:\. *Yau can even rename the folder—ta JUNESENT.FLD, far example—as lang as you rename the S13 file as well. Ta return ta yaur current set af messages, you again call up the communicatians manager and change the mail falder directory back ta* d:*MAILSYS.*

The advantage of this latter approach is that yau can view your messages fram within Express. *The disadvantage is that you have ta knaw which falder ta look in for a given message. However, yau can also use an indexing pragram with this approach and enjoy the best af bath warlds.*—M. David Stone

MICROSOFT MACROS AS TOGGLES

Many *Micrasaft Word* users create separate macros for turning a given feature on and off. But the Yes/No nature of many menu choices in *Micrasaft Word* lets you create macros that easily toggle between those choices. For example, you could create one macro, BORDON, to turn borders on and another, BORDOFF, to turn borders off. Or you can create a single macro, BORD, to do both. The macro

```
<Esc>o<down 2><right><space><Enter>
```

uses the Space bar to toggle the screen borders option between Yes and No.

Bob Brody
Los Angeles, California

This elegant approach ta creating macros saves an typing, glassary entries, and memory. And I can't think of a single strike against it.—M. David Stone

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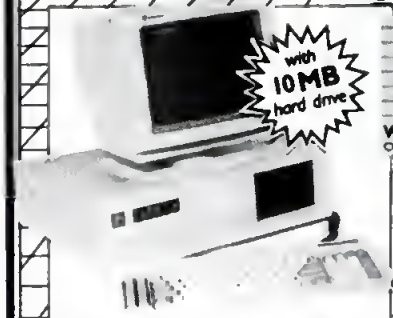
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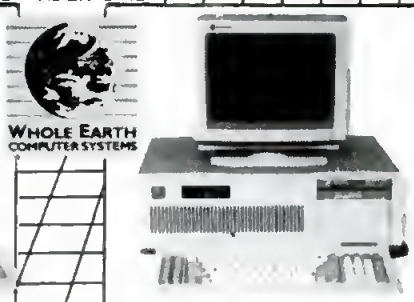


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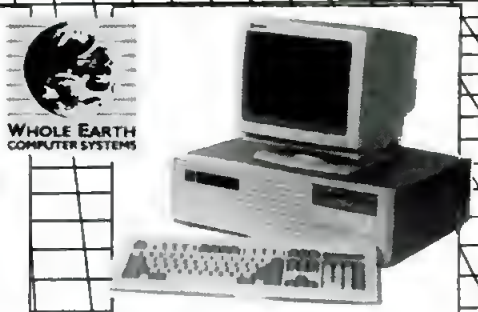
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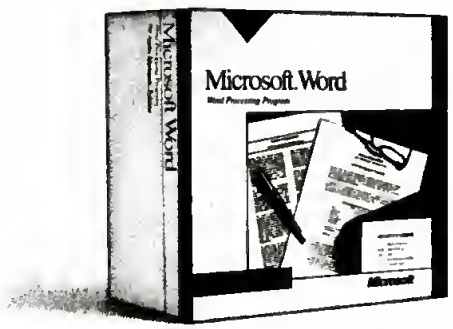
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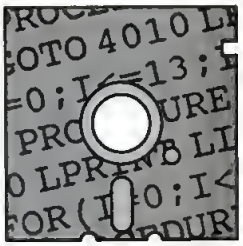
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■ EDITED BY ROBERT L. HUMMEL



LANGUAGES

Renaming files and directories; moving statements to shorten .EXE files in QuickBASIC; random file I/O with standard Turbo Pascal procedures.

QUICKBASIC

INCLUDE FILE CURIOSITY

When compiling a standalone program using QuickBASIC 3.0, the length of the .EXE file produced depends partly on the *order* of the various subprograms in the BASIC source code. For example, I have one program whose main module, along with several $Include subprogram files, totals 5,700 lines. I had placed all of the $Include statements at the end of the main program. Moving the $Include statements to the beginning of the main program shortened the .EXE file from 160K to only 158K. A bit of experimenting moving subroutines around may yield an even smaller final .EXE program size.

Norman Swartz
Burnaby, British Columbia
Canada

That is interesting. Even more interesting is the fact that Microsoft had no ready explanation either, other than suggesting that perhaps one of the $Include files contains a $Dynamic metacommand. In that case, any subsequent dimension statements will create code to set aside memory for arrays at runtime, rather than including the memory for arrays into the .EXE file.—Ethan Winer

TURBO PASCAL

SEEKING TEXT FILES

Turbo Pascal provides a convenient means of reading from text files with the standard procedures Read and ReadLn. Any text represented by ASCII characters can be read from a text file.

Part of the price paid for that convenience and flexibility is that Turbo Pascal does not support random access I/O on text files. That is, when the file pointer is at the start of the file and your program needs the 50th line, it must make a total of 50 calls to ReadLn!

Of course, in a typed file Turbo could calculate the offset of the 50th record and move the file pointer directly there. Why not use a file of strings if you need random access of textlike material? One reason: you must declare the length of strings before you can use them, and a file of strings will allocate the full length for each string. Another: you still wouldn't be able to use

```
PROGRAM SeekToTextDemo;

  FUNCTION SeekToText(VAR TextFile : Text; OffSet : Real) : Integer;
  TYPE {see the Turbo Pascal 3.X reference manual for the FIB layout}
    FIBtype = RECORD
      Handle, RecLength, BufOff, BufSize, BufPtr, BufEnd : Integer;
      FilePath : ARRAY[1..64] OF Char;
    END;              {FIBtype}
  VAR
    ByteFile : FILE OF Byte ABSOLUTE TextFile;
    FIB      : FIBtype ABSOLUTE TextFile;
    SaveRL   : Integer;
  BEGIN                           {SeekToText}
    WITH FIB DO
      BEGIN
        SaveRL := RecLength;      {RecLength actually holds flags and}
                                  {maybe a char from the text file}
        RecLength := 1;           {A byte file "record" is one byte}
        {$I-} LongSeek(ByteFile, OffSet); {$I+}
        SeekToText := IOResult; {The caller must deal with IO errors}
        RecLength := SaveRL;      {restore values for the text file}
        BufPtr := BufEnd;         {force next Read/ReadLn to refill buffer}
      END;
  END;                            {PROCEDURE SeekToText}

VAR
  DemoFile : Text;
  i, j     : Integer;
  MaxLine  : STRING[255];
CONST
  DFOffsets : ARRAY[1..4] OF Real = (95, 0, 143, 43);
  DFName = 'DEMOFILE.TXT';

BEGIN                             {SeekToTextDemo}
  Assign(DemoFile, DFName);
  {$I-} Reset(DemoFile);          {$I-}                    (continues)
```

Figure 1: *How to SEEK to a certain offset in a text file.*

■ LANGUAGES

```
  IF IOResult <> 0 THEN
    BEGIN
      WriteLn('Failed to open ', DFName);
      Halt(IOResult);
    END;                          {if IOResult <> 0}
  FOR i := 1 TO 4 DO
    BEGIN
      j := SeekToText(DemoFile, DFOffsets[i]);
      IF j <> 0 THEN
        BEGIN
          WriteLn('SeekToText failure with DFOffsets[', i, ']');
          Halt(j);
        END {j <> 0}
      ELSE
        BEGIN   {j = 0}
          ReadLn(DemoFile, MaxLine);
          WriteLn(MaxLine);
        END;                        {j = 0}
    END;                           {for i := 1 to 4}
  WriteLn;
  {$I-} Close(DemoFile);       {$I-}
  IF IOResult <> 0 THEN
    BEGIN
      WriteLn('Failed to close ', DFName);
      Halt(IOResult);
    END;                          {if IOResult <> 0}
  WriteLn('All operations concluded successfully.')
END.
```

(Figure 1 ends)

```
First line of the demo file: Karl Brendel
Second line:                 Anyoldtown, KS  12345
Third:                       Mookraker Systems
Absolutely the last line :   123 East A Avenue
```

Figure 2: *Contents of DEMOFILE.TXT, used by the program SeekToTextDemo.*

ReadLn to access those files.

In many text file applications, the lack of random access is no handicap. Some applications, however, cry out for both the speed of random access and the flexibility and ease of Read and ReadLn, e.g., a file of random-length ASCII records, such as a mailing list, or a help file, with subject matter of varying length. Wherever you want to start reading a text file somewhere in the middle, Turbo Pascal comes up short.

But when Turbo taketh away, it giveth as well: it allows one variable to be declared as absolute to another variable. This forces these two variables to start at the same memory location. A file is simply another variable, and a text file looks remarkably similar to a file of BYTE—enough so that a file of BYTE can be declared as absolute to the text file.

Turbo Pascal, Versions 2.*x* and 3.*x*, manage files using a File Interface Block (described on page 220 of the *Turbo Pascal 3.0 Reference Manual*, first edition). When you declare a file variable, Turbo allocates space for an FIB and assigns it to that file variable.

The only significant difference between the FIB of a text file and that of a file of BYTE, so far as I can tell, is in the value of the "record length" field. This value is 1 for the file of BYTE, but it is not constant for the text file. The low byte of the text file record length holds the flags with information about the file, and the high byte contains a read-ahead buffer. To make Turbo treat a text file like a file of BYTE, you only need to set the record length to 1 and tell Turbo to operate on the byte file. Be sure that you restore the record length byte before letting Turbo know that the file is really text! To force text input from the new location addressed by the file pointer, you must do a little more manipulation: set the buffer pointer equal to the end of the buffer, which will force the next Read or ReadLn to refill the buffer from the current location in the file.

I've written the function SeekToText to enable random access of text files. SeekToText takes a text file and an offset as parameters and attempts to locate the file's pointer at the offset, in bytes. It returns the value of Turbo's IOResult following the attempt. A program using SeekToText need only $Include it.

The little program SeekToTextDemo (Figure 1) uses the function to unscramble the lines containing my name and address from DEMOFILE.TXT (Figure 2), using offsets stored in the constant array DFOffsets. I got the values in the array by counting characters in a text editor (remembering to count line ends as two characters). In a real application, you would let the program determine the offsets.

Karl Brendel
Hutchinson, Kansas

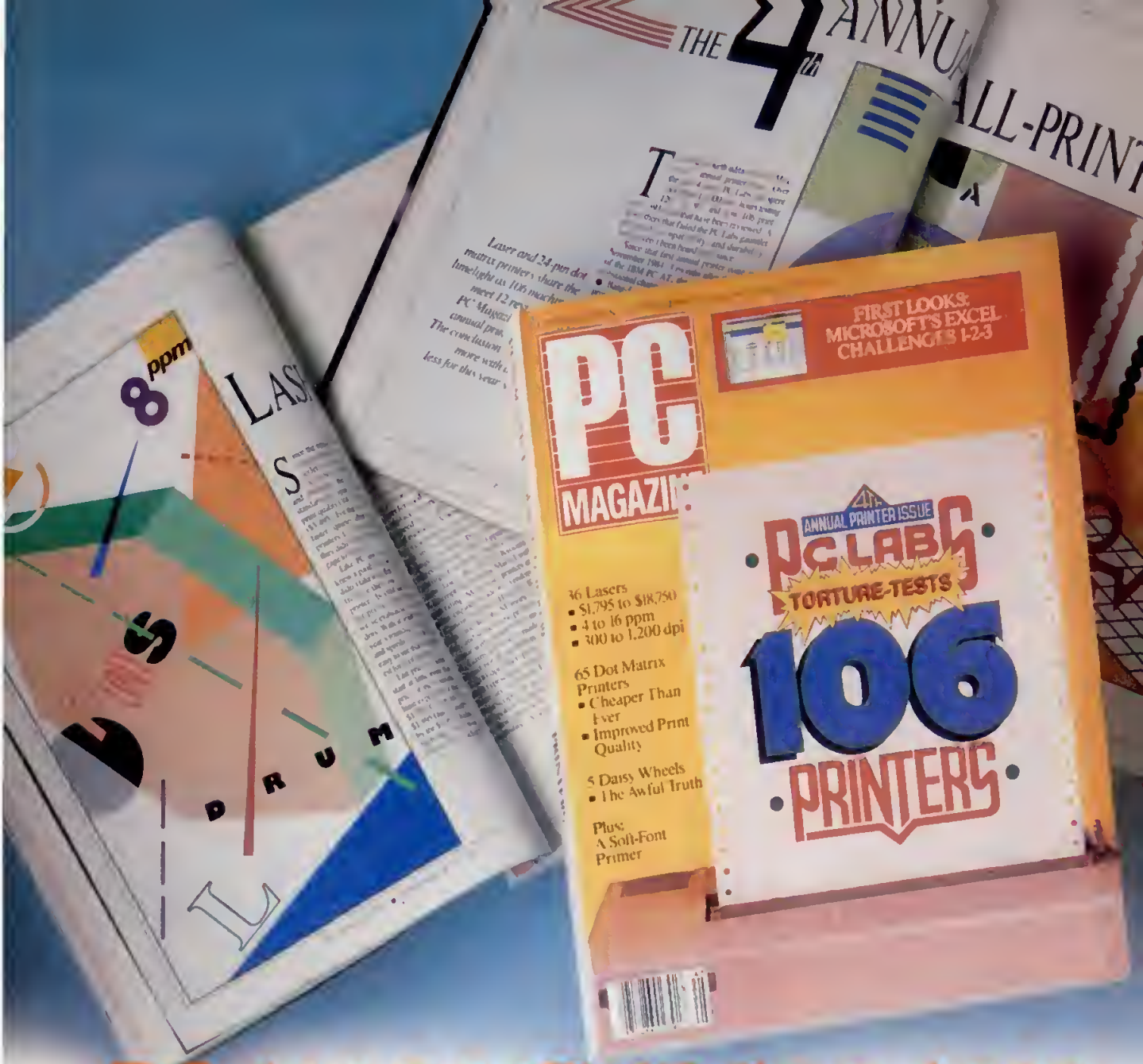
I picture using this technique on a file of help texts, as Mr. Brendel suggested. You might use a separate utility program to calculate the offset of each new paragraph of help text and save the offsets to an index file. Then your main program could jump directly to the correct spot in the help text and display the appropriate paragraph. Nice! But note that this technique is good only for Turbo Pascal, Versions 2 and 3—it won't work in the new Version 4.
—Neil J. Rubenking

FILE DATE AND TIME

The program FileDateAndTime (Figure 3) demonstrates a procedure to construct two strings with the Date and Time of any open file. I've incorporated it into a number of programs since its original development for a Pascal source lister.

I like to set up constants to make programs more readable. For example, DOS function names like `GetFileDateAndTime = $5700`, interrupt names like `VideoInterrupt = $10`, interrupt functions like `RequestVideoMode = $0F`, and so forth.

This program includes an "extended definition" of the 8086/8088 registers, using a Turbo Pascal SET to allow testing flags by name. `CarryFlag in FlagRegister` is clearer than `Odd(Flags)` is. Of course, if you're testing the Zero Flag, the difference is even more significant. `ZeroFlag in FlagRegister` is a lot better than either `(Flags and $40)=0` or `Odd(Flags shr 6)` is. Another advantage is that you avoid coding errors like



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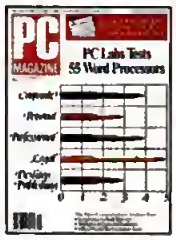
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12/22/87—Microsoft Excel reviewed; PC Labs tests 9 affordable 386-based PCs; 16 EGA Plus cards reviewed; 8 plotters; 6 TSR note-takers; 5 sales-lead trackers; Microsoft Windows; Omnis Quartz; Windows Graph; adding subdirectories and hard disk compatibility to rejuvenate old programs; FREE PRN2FILE.COM program printing utility; more.



12/8/87—15 hard disk storage cards examined; mail-order hard disks; 16 CAD packages priced under $500; dBASE report writers; one-piece PCs; Word 4.0; E-Mail for LANs; the Price Waterhouse Report integrated accounting package; creating and using program libraries; FREE CO copy utility; more.



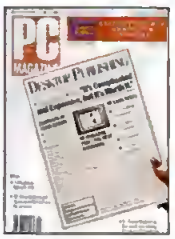
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9/29/87—PC Labs tests 12 hot 386 boxes; 12 keyboard macro programs; 13 full-featured project managers; laptop add-ons; 14 disk diagnostic programs; OS/2 and Languages columns premiere; first looks at Turbo C and IBM's Model 25; KBX keyboard extender examined; FREE RN subdirectory utility; more.



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■ LANGUAGES

```
{$R+,C-}
PROGRAM FileDateAndTime;

TYPE
  Str10 = STRING[10];
  Str2 = STRING[2];
  FlagType = (CarryFlag,     NoFlag0002,
              ParityFlag,    NoFlag0008,
              AuxCarryFlag,  NoFlag0020,
              ZeroFlag,      SignFlag,
              StepTrapFlag,  InterruptFlag,
              DirectionFlag, OverflowFlag,
              NoFlag1000,    NoFlag2000,
              NoFlag4000,    NoFlag8000);
  FlagSet = SET OF FlagType;
  RegisterType = RECORD CASE Byte OF
    0 : (AR, BX, CX, DX, BP, SI, DI, DS, ES, FLAGS : Integer);
    1 : (AL, AH, BL, BH, CL, CH, DL, DH : Byte);
    2 : (RegArray : ARRAY[1..9] OF Integer;
         FlagRegister : FlagSet);
              END;
VAR
  Registers                     : RegisterType;
  FileDate, FileTime, FileYear  : Integer;
  FileMonth, FileDay, FileHour,
  FileMinute, FileSecond        : Byte;
  FileDateString, FileTimeString : Str10;
  AFile                         : FILE;

  PROCEDURE InterpretFileDateAndTime(VAR AnyFile; VAR FDate, FTime : Str10);
  CONST GetFileDateAndTime = $5700;
  VAR HandleNumber : Byte ABSOLUTE AnyFile;
    YearString : Str10;

    FUNCTION ZeroFill(InByte : Byte) : Str2;
    VAR SF : Str2;
    BEGIN
      Str(InByte:2, SF);
      IF SF[1] = ' ' THEN SF[1] := '0';
      ZeroFill := SF;
    END;                        { Function ZeroFill }

  BEGIN
    WITH Registers DO
      BEGIN
        AX := GetFileDateAndTime;
        BX := HandleNumber;
        MsDos(Registers);
        IF CarryFlag IN FlagRegister THEN
          BEGIN
            FileDateString := 'Invalid';
            FileTimeString := 'Sendle';
          END
        ELSE
          BEGIN
            FileDate := DX;
            FileTime := CX;
            FileYear := ((FileDate AND $FE00) SHR 9)+1980;
            FileMonth := (FileDate AND $01E0) SHR 5;
            FileDay := (FileDate AND $001F);
            FileHour := (FileTime AND $F800) SHR 11;
            FileMinute := (FileTime AND $07E0) SHR 5;
            FileSecond := (FileTime AND $001F);
            Str(FileYear:4, YearString);
            FDate := ZeroFill(FileMonth)+'/'+
            ZeroFill(FileDay)+'/'+
            YearString;
            FTime := ZeroFill(FileHour)+':'+
            ZeroFill(FileMinute)+':'+
            ZeroFill(FileSecond);
          END;
      END;
  END;                          { Procedure InterpretFileDateAndTime }

BEGIN
  Assign(AFile, 'FDT.PAR');
  {$I-} Reset(AFile);           {$I+}
  IF IOResult = 0 THEN
    BEGIN
      InterpretFileDateAndTime(AFile, FileDateString, FileTimeString);
      Close(AFile);
      WriteLn(FileDateString, '  ', FileTimeString);
    END
  ELSE
    WriteLn('Where''s FDT.PAR?');
END.
```

Figure 3: *File date/time routine, using improved RegisterType, which works in Turbo Pascal, Version 3.0.*

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■ LANGUAGES

`Odd(Flags shr 5)` when you are able to test a flag by name.

Bob Berry
Sedona, Arizona

I highly approve of Mr. Berry's modified RegisterType. You have to check the flags after most DOS calls to be sure the operation succeeded. Using the SET type shown here, the flag-checking code will be much more readable.

This procedure takes advantage of the fact that Turbo Pascal determines the presence or absence of members in a set by checking if bits are on or off. The FlagSet TYPE corresponds exactly to the bit layout of the Flags word, so having member N in the set corresponds to bit N being ON.
—Neil J. Rubenking

RENAMING DIRECTORIES

I read with interest the PC Tutor column in the October 13, 1987, issue of *PC Magazine*. However, I felt that the suggestion to use BASICA to delete the entire contents of a subdirectory which had the misfortune to contain a blank in its name was rather extreme. I have enclosed a Turbo Pascal program that can rename the directory without deleting its contents.

Richard Burmeister
Fairfield, Iowa

Actually, the PC Tutor was asked how to remove *the directory, but renaming one is also a useful capability. I took great liberties with this program—in fact, I rewrote it entirely. The original used a DOS function call to do the renaming, but actually Turbo Pascal's own* rename *function will handle it. And because TP4 has "smart linking," a small utility like this doesn't take much disk space. RENSPACE.EXE is just over 3.5K.*

The program in Figure 4 illustrates a number of things about Turbo Pascal 4.0. First, all the compiler directives are OFF. This reduces the code size but deprives you of some protection. In a small program like this, that protection should be unnecessary. The next line sets the Memory requirements. We have no nested procedure calls, and the one procedure in the program takes no parameters, so we use the minimum value of 1024 for the Stack. We don't use the HEAP at all, so we set both minimum and maximum to 0.

In TP3, you could locate the command line parameters at the address CSeg:$80. TP4 programs compile to .EXE files, so you use a different segment, stored in the global variable PrefixSeg. The fact that this is a variable *is important—you can't use it in an ABSOLUTE declaration. TP4's typecasting feature saves the day here. The first line of the moin body of the program says, "Look at the bytes starting at PrefixSeg:$80 and consider them as a variable of type* commandStr. *Assign this value to the variable CommandLine."*

Note that you can rename any file or directory with this utility. Since the names can include spaces, you must *put them in quotes. For example:*

```
RENSPACE "foo bar" "foobar"
```

—Neil J. Rubenking

```
PROGRAM Rename_with_space;

{ NOTE: This is e Turbo Pescal 4.0 program, hut you cen cnnvert
  it for TP3 eesily enough.  There ere two pleces you heve to
  change, both marked with "(*TP3*)".  Look for that marker and
  fnllow tha instructinns.}

(*TP3*)(*Delate the next two lines for use with TP3*)
{$R-,S-,I-,D-,T-,F-,V-,B-,N-}
{$M 1024,0,0 }
TYPE
  commandstr = STRING[127];
VAR
  commandLine,
  nldname, nawname : commandstr;
  pstart, pend     : Byta;
  F                : PILE;

  PROCEDURE Error_Out;
  BEGIN
    WriteLn('SYNTAX: RENDIR "oldname" "newname"');
    WriteLn('The quntes around the two names ara REQUIRED.');
    Halt;
  END;

BEGIN
  commandline := commandStr(Ptr(PrafixSag, $80)^);
  (*TP3*)(*To use with TP3, nomment out the line above end
          UN-comment out the line below*)
(*  Move(MEM[CSeg:$80], nommandline, 128);*)
  pstart := Pos('"', commandline);  IP pstart = 0 THEN error_Out;
  commandline[pstart] := ' ';
  pend := Pos('"', commandline);    IF pend = 0 THEN error_Out;
  commandlina[pend] := ' ';
  (*The old name is the text between the first pair of "s*)
  nldname := Copy(commandline, Succ(pstart), Pred(pend-pstart));
  pstart := Pos('"', commandline);  IF pstart = 0 THEN errnr_Out;
  nommandline[pstart] := ' ';
  pend := Pos('"', commandline);    IF pend = 0 THEN errnr_Out;
  commandline[pend] := ' ';
  (*The new name is the text between tha second pair of "s*)
  newname := Copy(commandline, Succ(pstert), Pred(pend-pstart));
  Assign(F, nldname);
  Rename(P, newname);
  IF IOResult = 0 THEN
    WriteLn('Successfully renamed "', nldname, '" to "', newname, '"')
  ELBE
    WritaLn('Unabla to rename "', nldname, '" to "', newname, '"');
END.
```

Figure 4: *A Turbo utility to rename files or directories even if names contain spaces.*

SPEAK YOUR LANGUAGE

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■ ROBERT L. HUMMEL



PC TUTOR

Understanding how EGA and non-IBM "EGA-plus" cards add colors and handle borders, and when they can display more characters; examining the DEVICE= statement in DOS.

MISSING DEVICE DRIVERS

Recently, I added the statement

```
DEVICE=VDISK 128 512 32
```

to the CONFIG.SYS file on my PC-XT. I was delighted with the increased speed of disk operations on the RAMdisk. Everything worked fine until I needed all of my 640K to run *R:base*. To recover the necessary memory, I took the DEVICE= VDISK statement out of the CONFIG.SYS file and rebooted. After finishing with *R:base*, I tried to recreate the RAM drive, but received a "Bad or Missing VDISK" error message.

I'm having the same problem with our PC AT at work. Both systems are running DOS 3.3. First I had a RAMdisk on both systems, but now I can't get it going on either. The DOS documentation is no help. Can you tell me what's *not* happening?

Bill Douglas
Carrollton, Texas

One of the things that make using a computer so frustrating is that for no apparent *reason things just stop working. Yet you know that there really must* be *a reason. Solving the mystery requires examining the situation to determine specifically what is occurring and what is causing the problem, and correcting the cause.*

The first step is always to consult the manual. An explanation of the message "Bad or missing <filename>" is given in Appendix A of the DOS manual. This message, issued by DOS during start-up (booting) when it reads and processes the CONFIG.SYS file, indicates that the device driver file named in the DEVICE= statement could not be found.

To determine why the file could not be found, check the syntax for the DEVICE= statement. The DOS manual gives

```
DEVICE=[d:][path]filename[.ext]
```

*where the parameters shown in brackets are optional but have default values. If no drive is specified with the [*d:*] parameter, DOS substitutes the current drive. Similarly, if the [*path*] argument is not used, the root directory will be assumed. There is no default device driver name, so this* must *be specified.*

The filename.*[*ext*] parameter is, however, very misleading and provides an example of how reading a manual can be counterproductive. The extension parameter ([*.ext*]) is shown as optional and separate from the filename when, in reality, it is neither. The full filename,* including extension, *must always be specified. The DEVICE= statement in Mr. Douglas's letter will fail because the correct device driver name is VDISK.SYS, not VDISK. Unlike executable programs, no default file extension is assumed by DOS when processing the CONFIG.SYS file.*

In addition to changing the DEVICE= line in the CONFIG.SYS file, check to see that the VDISK.SYS file hasn't accidentally been erased from the root directory. If the file isn't present, it won't load—even with the correct syntax!

■ One of the things that make using a computer so frustrating is that for no *apparent* reason things just stop working.

MOVING-BAR MENUS

A program menu where you must type a number or letter to choose an option has always proved adequate for my needs. Nevertheless, I've always admired and envied the moving-bar menus used in many commercial programs. *Microsoft Word* and *Lotus 1-2-3* use this type of menu universally. How is this done? And, is the code available in BASIC, assembler, or C?

Jacob Heskes
Forest Hills, New York

The moving-bar (or point-and-shoot) menu is one of the great user interfaces available today. Almost any program, commercial or otherwise, benefits by including it. Many of the utility programs that have appeared in the Productivity section use the moving-bar menu and include the commented assembly code necessary to implement it. For a practical tutorial and working code to implement this interface, see the PC Lab Notes and Utilities columns in the May 26, 1987, issue of PC Magazine. *The two assembly code utilities*

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■ PC TUTOR

presented there, SLASHBAR and MAKEBAR, implement a complete moving-bar menu system.

If you don't have the May 26, 1987, issue in your collection but want to read the article, check with your local library. Most should have older issues of PC Magazine *on file. Failing that, someone in a local PC User Group is bound to have a copy. And remember that all our utilities, in source code and executable versions, are available via modem from PC MagNet. General instructions for using this facility are given in a sidebar of the Utilities column in each issue.*

A 132-COLUMN EGA

I just traded my PC*jr* for an AT compatible with an EGA video card and multiscanning monitor. I wanted the EGA for better character resolution and 132-column display. I got the better resolution. But while the MODE command can give me 40 or 80 columns, I can't get 132 columns.

I assumed that all the software I had was probably written before there were high-resolution monitors and so wouldn't support 132 columns. I ordered the latest versions of IBM's *Assistant*-series programs, but found that they don't support 132 columns either. Why hasn't Microsoft put the ability to select this display mode into MS-DOS?

On my old CGA monitor, setting the border color caused the whole screen to be filled. With the EGA, there is an ugly black border around the edge. I thought it had something to do with the resolution of the screen and monitor, but I have learned that it's inherent in EGA systems. Can you explain the reason?

I'm also having problems getting color while in DOS. All the short programs designed to give me color cause my programs to crash. I can operate fine in black and white, but that's not why I bought a color monitor!

James A. Wahl
Trussville, Alabama

Mr. Wahl's questions raise several interesting points regarding the purchase and performance of EGA display systems. I'll address each separately and, in doing so, I'll show where the distinction lies between systems that conform to the design that IBM created and systems used by third-party manufacturers whose "EGA-plus" cards go beyond the IBM standard.

The EGA, like the CGA before it, was designed to operate in two very different modes: character *mode and* graphics *mode. In character mode the display is divided into distinct rows and columns, somewhat like a checkerboard. The intersection of each row and column is called a character box and can hold a single, complete* character.

*When a PC with a typical color EGA system is booted, the BIOS initializes the hardware to character mode 3: 80 columns wide and 25 rows high. Thus, a maximum of 4,000 (80 * 25) characters can be displayed on the screen at once, and only in the boxes formed by the intersection of the rows and columns.*

Each character on the screen is really formed by an arrangement of smaller dots of light. On the EGA, the default character box for mode 3 is 8 dots wide and 14 dots high. These dots are called picture elements, or pixels. *(In its typical iconoclastic fashion, IBM shuns the use of the term pixel and uses the term* PEL *instead. Likewise, the term* line *is used for pixel when referring to character height.) With a little multiplication, we find that in mode 3 the EGA is really displaying 640 pixels across the screen and 350 pixels down. (In its highest-resolution graphics mode, each pixel is under direct control and can be turned on and off individually.)*

■ There's a difference between IBM's EGA and "EGA-plus" card systems that go beyond the IBM standard.

DISPLAYING MORE CHARACTERS

The EGA is designed so that the height of a character is under software control and thus can be changed. A new set of characters, called a font, *can be loaded into*

*memory. Even more important, the height of the new characters can be different from the default 14 pixels. If a font that is 8 pixels high is loaded, for example, the EGA can be used to display 43 lines of text (43 * 8 = 344 pixels high).*

Unlike the height, however, the width of the character box cannot be changed.

■ Until the EGA came along, all displays were assumed to be 80 columns wide and 25 rows high.

*The IBM EGA design requires that the character box always be 8 pixels wide. The monochrome text mode of the EGA is also restricted to a character box that is 9 pixels wide. Thus, in order to display more characters across the screen, more pixels must be generated on each line. To increase the number of 8-pixel-wide characters across the width of the display to 132, for example, a total of 132 * 8 = 1,056 pixels must be displayed. This is done by increasing the frequency of the* dot clock *and reprogramming the CRT Controller.*

IBM's EGA, as it comes from the box, contains only the standard dot clock and so cannot display more than 80 characters on a line. Other EGA makers, as they improved on IBM's design, added more features, including dot clocks of different frequencies. Because these features go beyond the support of the BIOS, DOS, and the MODE command, special software, usually supplied by the manufacturer, must be used to take advantage of these enhanced modes. The GENOA SuperEGA card installed in my system, for example, comes with a control program that lets me select from over 40 display modes, including displaying text as 80 by 25, 94 by 29, and 132 by 44.

Until the EGA came along, all displays were assumed to be 80 columns wide and 25 rows high. Because of this, many programs were written with these numbers hard coded *as absolute values. For a program to work with something besides the standard 80 by 25 screen, it had to have been designed to accommodate different screen sizes. While some application programs, such as* WordPerfect, *added support for extended display modes, many other popular programs, such as* Lotus 1-2-3, *did not. And since IBM does not sell hardware configured to produce more than 80 columns on the screen, don't expect to see support for anything but 80 columns in its software.*

THE EGA BORDER *If properly adjusted, the CGA border completely fills the area between the edge of the text and the edge of the physical display. When set to the same color as the background, this gives a very pleasing effect. In order to achieve its higher resolution, however, the EGA must spend more of its time drawing in the character region of the display. Very simply, this leaves the EGA less time than the CGA to draw a border and results in a smaller border.*

For a complete and comprehensive examination of the EGA, fonts, and instructions for constructing an external dot clock for your current EGA, see Charles Petzold's two-part series in the August, 1986, and September 16, 1986, Programming/Utilities columns.

ADDING COLOR TO THE EGA *Being forced to boot up an expensive EGA system in gray on black because DOS isn't smart enough to recognize a color monitor is one of my pet peeves. To solve this problem and gain access to the full 64-color EGA palette, I recommend the SPECTRUM utility, which was published in our June 23, 1987, issue. Both SPECTRUM and the many EGA utilities in Petzold's EGA series are available for downloading from PC MagNet.*

ASK THE PC TUTOR

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally.

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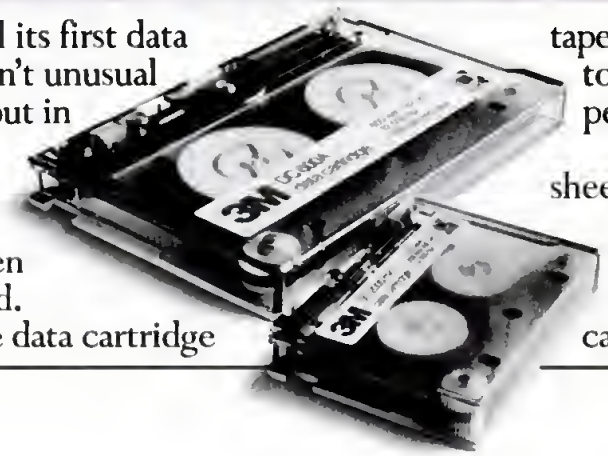
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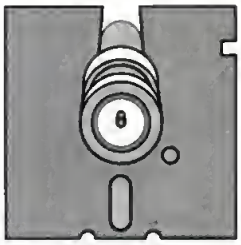
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■ FRANK J. DERFLER, JR.

CONNECTIVITY CLINIC



Connecting laptops to LANs; protecting data against power interruptions; adding more storage to improve system performance and reliability; mixing network operating systems.

ADDING MASS STORAGE

You've written that it's smart to use more than one hard disk drive on a server to split the load of data I/O requests. In addition, you have said that the server's hard disk drive is the choke point in network performance.

I want to put two drives in the server, but my dealer advises that large-capacity hard disk drives have faster response times than smaller drives. Whose recipe should I follow?

Emie Sage
New York, New York

Everybody wins. Your dealer is correct that big drives have faster average data access times. I'm right when I say you can improve performance by splitting the data load. Putting two drives in a server also gives you better system reliability. The most reliable backup is hard disk to hard disk.

My recipe for a server calls for stuffing two of the largest hard disk drives that make sense for your organization. Measure out 10MB per user and add about 20 more or so to taste. Then stir in enough bytes to hold your largest shared data files. Blend smoothly in a big metal box and frost with software. Serve the server slightly warm with plenty of napkins.

MIXING OPERATING SYSTEMS

I read your description of how you run different network operating systems on the same cards and cables at PC Labs. We would like to set up a similar network with at least three different network operating systems, including *NetWare, 3+Share,* and *Tapestry* using 3Com EtherLink cards. I would appreciate any suggestions you may have.

Herbert Halasz
Wellington, New Zealand

You won't have a problem mixing these operating systems on the same hardware. I'm sure you understand that each workstation runs only one brand of LAN operating system at a time. However, Tapestry *workstations can interact with* Tapestry *servers at the same time and on the same cable while* 3+Share *workstations interact with* 3+Share *servers, and so on.*

NetWare *comes with selections in the workstation and server configuration menus for the 3Com cards. 3Com's* 3+Share *is ready to run on the 3Com hardware. The standard version of* Tapestry *runs over the NetBIOS interface software. It's important to make sure you get NetBIOS from 3Com with the EtherLink cards. Don't try to use a NetBIOS program that Quadram or other vendors distribute with* Tapestry, *because each vendor's NetBIOS is customized for specific hardware.*

When you want to run a NetBIOS-compatible network operating system like Tapestry, *IBM's* PC LAN, *or* LANtastic, *read in the 3Com NetBIOS software from a batch file and then start the networking software.*

We boot all our workstations from a floppy disk so we can have the right assignment of buffers, files, and drives in the CONFIG.SYS file for each operating system. Changing network software is as easy as changing diskettes. Label each boot diskette carefully, and you will have a very flexible LAN development system.

■ My recipe for a server calls for stuffing two of the largest hard disk drives that make sense for your organization.

WIRING ALTERNATIVES

We need a good source of information about wiring alternatives for our new offices. Should we have coaxial cable, fiber-optic cable, or something else put in the walls? Are there any good planning guides available?

Becky Chambers
Woodbridge, Virginia

There are many companies that would like to help you wire your walls—though each has an ulterior (if not interior) motive. IBM, AT&T, DEC, and Northern Telecom all have standard building wiring plans. Some of these plans are pretty expensive to implement. Several of the others don't provide connections for equipment outside their own product line.

■ CONNECTIVITY CLINIC

Of them all, I like AT&T's Premise Distribution System the best. From everything I can see, it makes the most sense. AT&T's plan is heavy on twisted-pair wiring (of course), but they also use fiber in the right places. The fiber they specify is compatible with the developing Fiber Distributed Data Interface specifications.

My "not recommended" list of books describing building wiring plans is a lot longer than my recommended list. A book with the promising name Wiring Up the Workplace *by Camrass and Smith is an elementary tutorial without much practical information. The best help I've found comes from a professional organization called Building Industry Consulting Service International. It publishes the* Telecommunications Distribution Methods Manual, *which costs $99 and is distributed by GTE Testmark Laboratories, 3050 Harrodsburg Rd., Lexington, KY 40503.*

DO YOU NEED A UPS?

Our company is putting together an eight-node network using Novell's *NetWare*. The vendor suggests purchasing an uninterruptable power supply (UPS) system. What does this kind of power supply do, and is it really necessary?

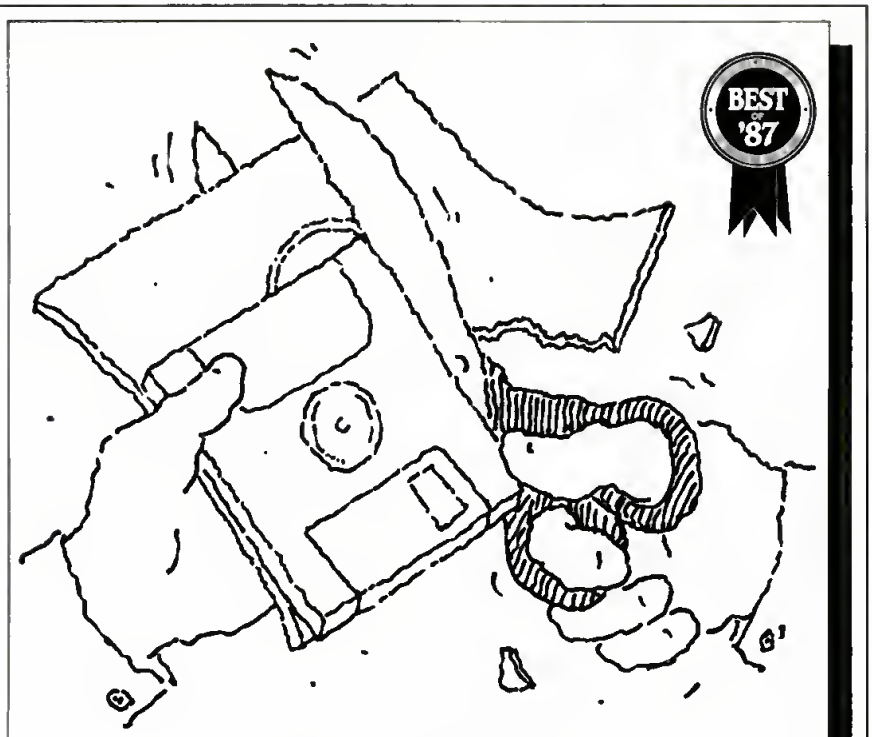
Lloyd Kinnear
Narragansett, Rhode Island

Get hold of the September 16, 1986, issue of PC Magazine *("Backup Power: When the Juice Stops Flowing") for a full explanation and review of UPS products. Briefly, a UPS provides 110-volt AC power when the wall socket goes dead. Some models also defeat voltage spikes and brownouts. The cost of these devices is directly proportional to how much current they supply and for how long.*

■ *NetWare* has the tools to remedy any open file or FAT problems you might have after a power bump.

Your need for a UPS depends on the importance of your LAN. If your system must stay up no matter what happens (brokerage houses feel this way), then you need a UPS able to power the server and workstations for an hour or more.

If your organization can do without the LAN during a power outage but relies heavily on a networked DBMS, you should consider a small UPS able to keep the server running for 5 minutes or so. This



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gives someone enough time to close any open files and make sure a current file-allocation table is written to the disk.

Since you already use NetWare, *you should know that current versions of Novell's* SFT NetWare *can respond to a signal from a UPS and start an orderly server shutdown.*

If you primarily use your LAN for file storage and printer sharing, I don't think you need a UPS. NetWare *has the tools to remedy any open file or FAT problems you might encounter after a power bump.*

LAPTOPS ON A LAN

I want to use my Toshiba laptop on an Ethernet LAN while I'm in the office. What's the best way to do it?

Susan Schechinger
Oakton, Virginia

The best solution I've found for putting laptops on any LAN comes from Connect Computer in Eden Prairie, Minnesota. Its product called Wonunder lets you add almost any type of expansion card, including LAN cards, to several models of Toshiba and Zenith laptop computers.

The Wonunder cabinet sits under the back of the laptop (it tilts the unit up an inch or so) and accepts any 8-bit expansion card up to about 10 inches in length. My Toshiba T1100 Plus still fits in its carrying case with the Wonunder installed.

The Wonunder accommodates a Token Ring card, but it works fine for the majority of network interface cards and many manufacture 3270 coaxial adapters. You can call Connect Computer at (612) 944-0181. The Wonunder sells for $379.

NETWORK YOUR QUESTIONS

Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay $50 or more for any tips we print, *plus an extra $25 if you submit your letter on a disk,* and we'll gladly answer any questions you have, at no charge. We're sorry, but we're unable to answer letters personally.

Mail your contributions to Connectivity Clinic, *PC Magazine,* One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named CONNECTIVITY CLINIC). PC

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CIRCLE 378 ON READER SERVICE CARD

EXCERPT FROM PC WEEK REVIEW MARCH 8, 1988. USED WITH PERMISSION.

Database Add-In for 1-2-3 Has More Capabilities Than Rivals

by Marvin Bryan

The king of the crowded forest of Lotus 1-2-3 database add-ins is unquestionably @BASE...

@BASE was developed by Personics Corp. of Concord, Mass., makers of the popular SeeMORE utilities that add additional columns to the screen displays of Lotus 1-2-3 and Symphony.

With @BASE, it's possible to build colossal 32 M-byte databases in the standard dBASE III Plus format without ever using dBASE itself. Users can convert a normal 1-2-3 database instantly into a dBASE-compatible file, as well as set up dynamic links that will import updated information from dBASE records every time a worksheet is recalculated.

A database can be sorted alphabetically, numerically or chronologically on as many as 128 levels. In fact, @BASE will pack and sort records as much as three times faster than dBASE...

Data can be analyzed with a cross-tabulation module to provide lightning-fast reports in response to such questions as: "What sales people in each division earned more than $20,000 in commissions this month?"

In addition, records can be entered or examined in a form view, where each record occupies an individual screen. Alternatively, of course, the user can choose the usual one-record-to-a-line format.

We tested the current $195 release of @BASE along with a beta copy of the Option Pac, which will retail for $89.95. **Together, these two relatively inexpensive products provide truly remarkable functionality.**

In addition to the indexing feature, the Option Pac will join files to make relational databases, create computed or derived fields, sort a database without rearranging the records on disk, and automatically keep files in the correct sorting order during record entry or updating.

See our ad on page 63.

As a bonus, dBASE data can be turned into 1-2-3 graphs with practically no effort at all...

Personics has developed a series of @DB functions to perform calculations and evaluate records within @BASE...Each of these functions use one or more arguments to identify the database, record or field to be acted upon. Some functions allow criteria to be established, such as selecting a subset of records.

The 200-page manual for @BASE is excellent...The program adds less than 80K bytes to the RAM overhead of 1-2-3. **For those who use both dBASE and Lotus 1-2-3, @BASE is practically a requirement.** ■

@BASE™

A database add-in for Lotus 1-2-3 that will access and create dBASE files without the use of dBASE itself. A superior product in every respect.

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TIPS WHEN ORDERING

When ordering by mail:

State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

Save all correspondence associated with your order, including your cancelled check or a copy of the money order, and any written confirmation sent by the Seller.

Questions you should consider asking:

Does the advertised item come with all necessary parts and accessories? Are they from the same manufacturer?

Is it available for immediate shipping?. If not, when will it be available?

Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

IF YOU HAVE PROBLEMS:

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.

2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

PC Magazine's Direct Marketing Connection For PC Products and Services

For many of you, mail order is your primary means of purchasing PC products and services.

In fact, in recent interviews with our subscribers, we learned that 70% bought PC products and services through direct marketing channels during the past year.*

You buy direct because it's convenient, because you know exactly what you want and don't need any hand-holding.



PC MAGAZINE

The following special section, PC Magazine's Direct Marketing Connection, is what you've been demanding. It connects you with the direct marketers who are anxious to please you. By having them all in one place, you can quickly zero in on the products you need from the vendors you want to buy through.

*Starch Study, July 1986

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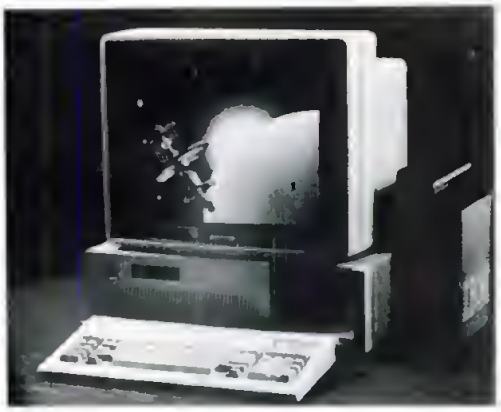
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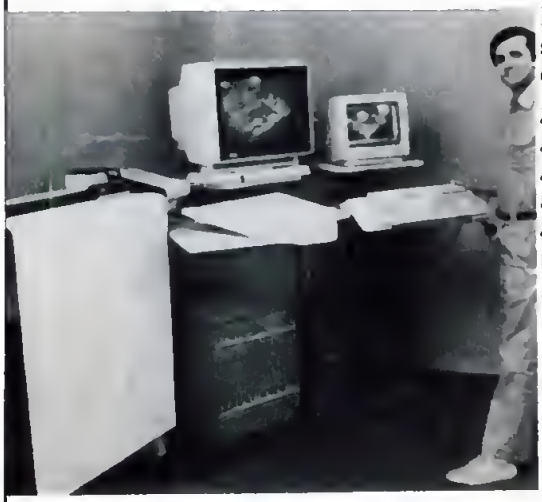
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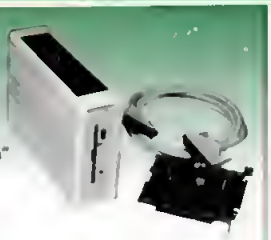
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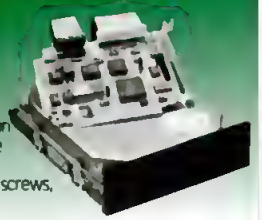


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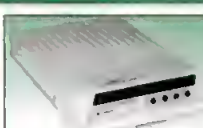
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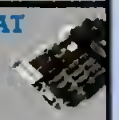
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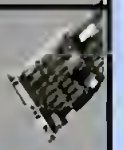
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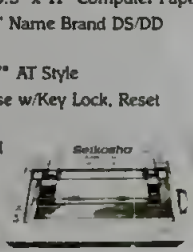
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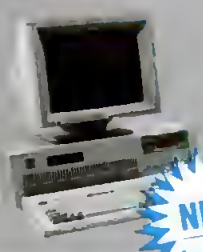
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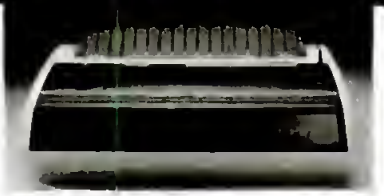
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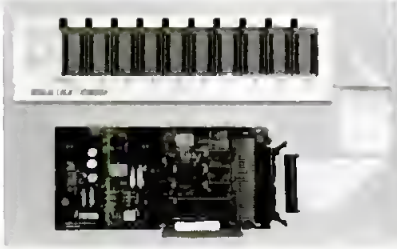
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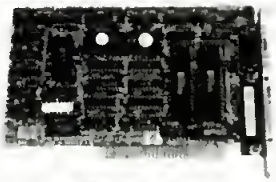
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7. Intel 32-Bit 80386-16 Microprocessor
 —Operating at 16MHz "0" Wait
 —Software-Selectable of Four Speeds: 4.77/8/16
8. Performance Rating: MIPS = 2.03, SI = 18.7, Landmark = 20.5
9. 80287/80387 Math Co-Processor Socket Installed
 —80387 Is a 32-Bit Operation
 —80387 Is Available in DOS/OS/2 Xenix Systems V/386/ix, VMS, MOS 386
 —80387 Runs with Turbo Pascal/Autocad Version 2.60/9 and CAD/CAM Support
10. Eight Expansion Slots: 2 8-Bit, 5 16-Bit, 1 32-Bit
11. Operates OS/2, MS-DOS, PC-DOS, Unix V, Xenix & Windows/386
12. Runs All MS-DOS Software Including Lotus 1-2-3, WordStar, Autocad, Flight Simulator, dBase III Plus, Symphony, etc.
13. Software Utilities Including
 —Relocatable EGA and Sets up BIOS from ROM to RAM
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14. Fully Compatible w/AT Mechanical Mounting Locations
15. Real-Time Clock w/Battery Backed CMOS Memory for System Configuration Data
16. Three Address Modes
 —8086-Compatible Real Address Mode
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17. Sixteen Interrupts
18. Seven Direct Memory Access (DMA) Channels
19. 64 Terabytes of Virtual Address Space
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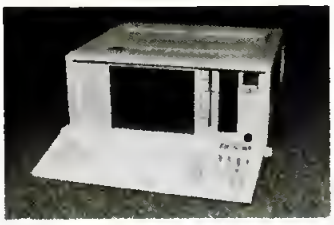
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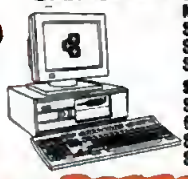
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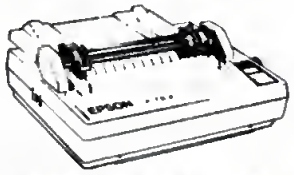
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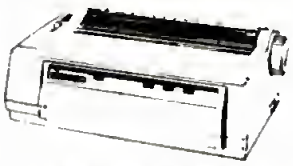


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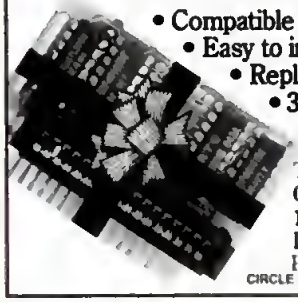
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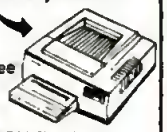
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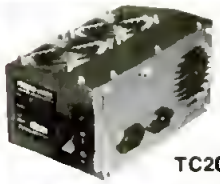


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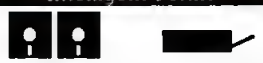
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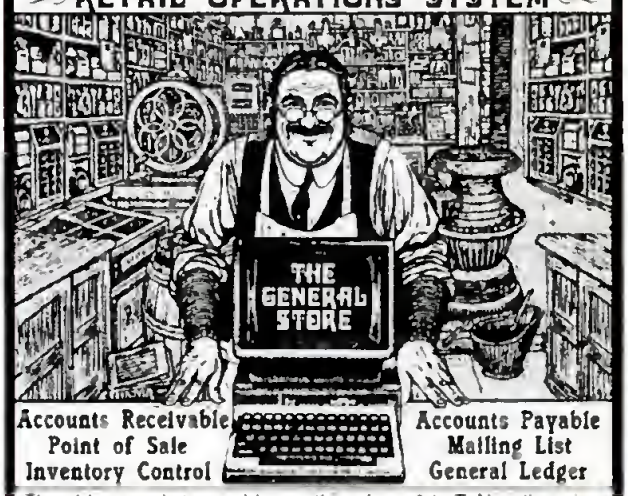
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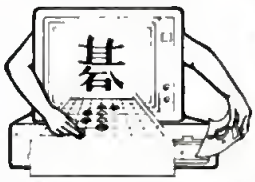
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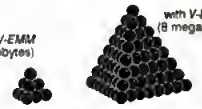
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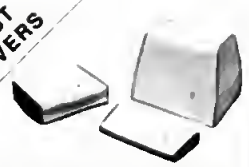


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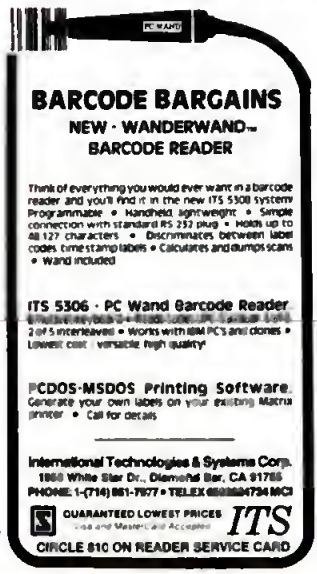
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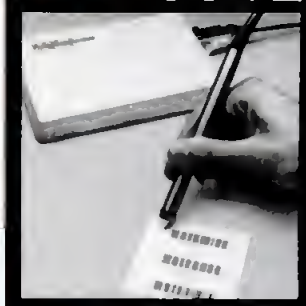


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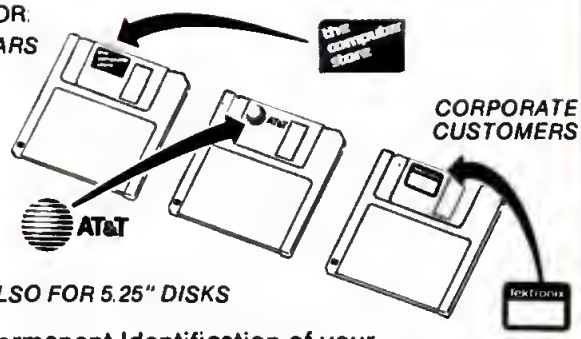
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COMMUNICATIONS SOFTWARE A new generation of communications software has emerged, sporting script languages that rival programming languages for versatility. Whether minimal, advanced, or new-generation, these programs allow you to automate your communications or build new features into your system. Our team of reviewers examines 21 contenders that are redefining the high end of the communications market.

NINE NEW ATs Demand for AT compatibles is stronger than ever, and competitors in that huge market are looking for ways to stand out in the crowd. Take a look at the newest machines from Amdek, American Mitac, Arche Technologies, Core, Dataworld, Epson, Hyundai, Kaypro, and Star Industries.

HALF-INCH-TAPE SUBSYSTEMS Now cost-effective half-inch magnetic tape may be the answer for users who regularly need to move data between PCs and mainframes. Our workgroup systems editor, Frank J. Derfler, Jr., evaluates controllers and tape drives from AK Systems, Alloy Computer, Catamount, Chi, Cipher Data Products, Contech Computer, Emerald Systems, Flagstaff Engineering, Innovative Data Technology, Overland Data, and Qualstar.

SCIENTIFIC WORD PROCESSORS The latest scientific programs simplify the once-cumbersome task of integrating text and technical character sets. Jim Seymour traces the evolution of these WPs from Donald Knuth's *TEX* to the 12 products reviewed in this issue. PC

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AFTER HOURS

GAMES

Space Quest II: Attack Of the Pushy Insurance Salesmen

BY STEPHANIE K. LOSEE

Lovers of challenge, come hither! Sierra On-Line has the game for you, particularly if unsolved problems keep you awake at night.

Space Quest II: Vohaul's Revenge is the second episode in the adventure of Roger Wilco, the janitor/hero who foiled the evil plot of Sludge Vohaul in *Space Quest I: The Sarien Encounter*. You play the part of Roger and if you don't thwart Sludge again, hordes of pushy insurance salesmen will invade your planet.

As you blunder your way through jungles and space stations, the game presents you with obstacles, most of which prevent you from continuing. These obstacles demand creative solutions, which can often be tough to come by, even for experienced game-players. I had twice as much fun playing the game with PC Labs guys yelling suggestions in my ear; brainstorming yields better results than staring at the screen with a frown on your face. But don't kid yourself by thinking you'll get by without the Hint Book—you won't.

The program works like an interactive fiction game with graphics. Move your hero by using arrow keys, and issue commands in short sentences to take specific actions.

Space Quest's 3-D graphics are terrific in EGA, as are the special effects. CGA is disappointing—with only four colors, many of the more-detailed graphic elements aren't visible.



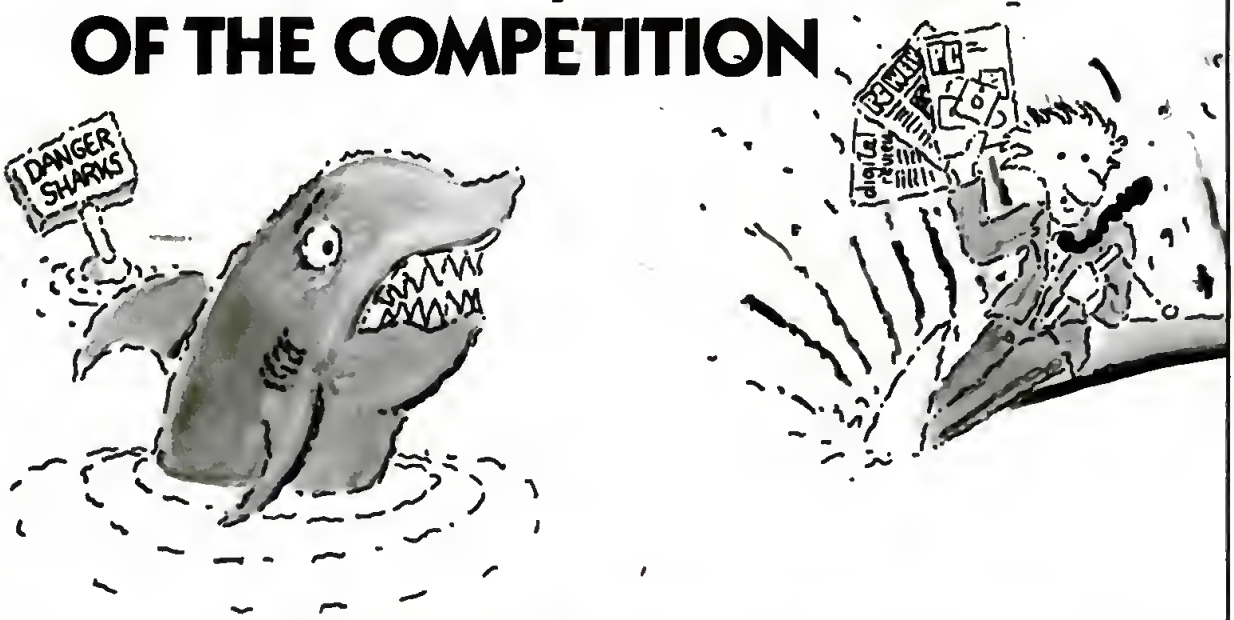
Only you can save the earth from the evil Sludge Vohaul and the hordes of pushy insurance salesmen he commands.

You may not avert the invasion of the dreaded insurance salesmen, but you'll have a good time trying.

List Price: *Space Quest II: Vohaul's Revenge*, $49.95; Hint Book, $7.95. **Requires:** 256K RAM; one disk drive; EGA, CGA, or Hercules graphics; DOS 2.0 or later. Copy protected. Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614; (209) 683-6858.

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CIRCLE 477 ON READER SERVICE CARD

AFTER HOURS



Take your rightful place in the annals with Salinon's Footprints in History. *Or butter up a hard-to-buy-for relative with a customized personal history.*

ART & LEISURE

This Is Your Life Meets The March of Time—On-Disk

BY PAUL V. OLOWACZ

Ever wondered when the first camel race in America was held, or when the waffle iron was invented? Or do you prefer to ponder how your life fits into the grand scheme of things?

Either way, you'll enjoy The Salinon Corp.'s two new entries in its Life & Times series, *Special Days* and *Footprints in History*, which aim to please trivia nuts and cravers of historical glory.

Both programs draw on a database to link facts and esoterica to your personal milestones. Each also prints a scroll-like document for "that 'special' gift for Uncle Norman." And while each contains mistakes and dubious facts, both are good for a few laughs.

Special Days accepts any date from 01/01/1850 onward and draws up a report, or Timescript, in formats suited to a birthday, anniversary, or other special event.

The Birthday report contains the liveliest mix of nonsense: "On This Day" listings and birthdates; top tunes, grocery prices, award winners, and sports champs for the year; and "familiar faces" from your home state.

The Anniversary Timescript's "through-the-years" format is skimpy. The Flashback report (on an event of your choice) regurgitates an impressive list of "fond memories from yesteryear."

Naturally, you'd expect the content to be quirky—and it is. Each luminary mentioned gets a thumbnail description—"author," "actor," and so on—but why is director Vincente Minnelli a "show biz guru"? Also, the post-1970 years are loaded with birthdays of TV child actors and celebrities' kids you've never heard of. But the database is amazingly current: even Jimmy Swaggart's confession popped up.

While *Special Days* exudes the rather cozy nostalgia of an almanac, *Footprints* treats you with the importance you deserve amid the tides of human endeavor.

You create a "VIP File" by entering dates and events you want featured. *Faatprints* weaves a "TimeLine" around your chronology, surrounding it with then-current events. It even trumpets your achievements in boldface capitals. The effect is like being the subject of a ponderous "March of Time" newsreel. The mighty struggles of the Cold War pale beside your kindergarten graduation.

Another option, the SnapShot, reviews the era of a key event supplied by you or culled from the files by the Key Search function.

The idea stressed is that these printouts make great gifts. Salinon even offers parchment paper for an antique look—not to mention a licensing agreement for commercial use.

Special Days and *Footprints* are silly, superficial, and—for certain people—wackily entertaining. In a word: *trivial*, and unashamedly so. If that's your pursuit, you should treat yourself to them. And many happy returns of the day.

List Price: *Speciol Doys* and *Footprints in History*, $39.95 each. **Requires:** 256K RAM, one disk drive, DOS 2.0 or later. Not copy protected. The Salinon Corp., P.O. Box 31047, Dallas, TX 75231; (800) 722-0054.

CIRCLE **658** ON REAOER SERVICE CARD

GAMES

High-Tech Sleuthing With Infocom's Sherlock

BY NEIL J. RUBENKING

Infocom's *Sherlock: The Riddle of the Crawn Jewels* pits you against Sherlock Holmes's nemesis, Professor Moriarty. Her Majesty's Golden Jubilee is only two days away, and Moriarty has stolen the Crown Jewels. The Queen must wear the jewels for the Jubilee; their loss is a disaster. Moriarty has left plenty of clues, clearly intending to lead Holmes into a trap. In order to derail the Professor's plans, the Great Detective introduces a random factor by putting you, Dr. Watson, in charge of the investigation.

Solving Professor Moriarty's poetic clues requires some knowledge of English history. For example:

For two-score years I reigned alone,

A virgin queen on England's throne.

My navy caused Armada's shame,

And with me died the Tudor name.

You'll find other clues in the package. Infocom supplies a map of London and the previous day's *"Londan Thames."* Do look beyond the obvious places for clues—at least one important clue is found only in the Instruction Manual. You must find and solve the clues in order to figure out what to do next.

Sherlack features Infocom's new on-line hints. These are an electronic version of the "Invisiclues" hint booklets available for older games. With them, you can solve Moriarty's verses even if your historical knowledge is limited to King Arthur and Princess Di. Of course, the list of questions is a clue in itself, so the game advises against using hints. In fact, you can turn HINTS OFF to avoid temptation.

Every time you enter a command, time passes. You have just 48 hours to find the stolen jewels and save England's pride. If you run out of time, simply start over. With the knowledge you've gained, the next time will go faster. When you know exactly what you're doing, you can solve almost all the clues in less than 12 game hours. Certain events happen at fixed times, so the final minutes will always be a frantic rush.

Sherlock is the first of what Infocom calls its "Immortal Legends" series, based on familiar characters from English literature. It's an auspicious first offering, and one that Friends of the Great Detective and adventure gamers alike will enjoy.

List Price: *Sherlock: The Riddle of the Crown Jewels*, $39.95. **Requires:** 192K RAM, one disk drive, DOS 2.0 or later. Not copy protected. Infocom, 125 CambridgePark Dr., Cambridge, MA 01240, (617) 576-3190.

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AFTER HOURS

GAMES

Yo Ho Ho and a Bottle Of Rum: MicroProse's Pirates! Lets You Roam The Spanish Main

BY STEPHANIE K. LOSEE

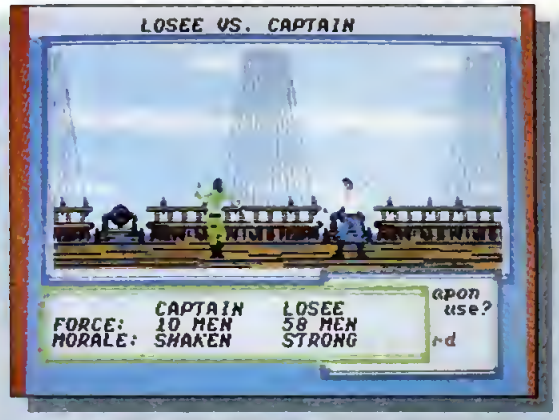
On Sunday afternoons do you find yourself curled up in front of the TV, watching pirate movies and yelling insults at the swashbucklers on the screen? MicroProse's *Pirates!* takes you off the couch and onto the buccaneer's ship.

Pirates! is a detailed, historically accurate simulation of pirate life on the Spanish Main between 1560 and 1700. As captain you sail through the Caribbean, plundering towns, pumping cannonballs into enemy ships, and dueling with pirate captains.

You begin by choosing a time period or defaulting to The Buccaneer Heroes (1660), "when piracy was at its peak." More-experienced players can select a famous expedition to see if their naval skills measure up to Sir Francis Drake's. Next, select a nationality, level of difficulty, and special skill, and you're set to sail.

Your goal is to have a successful and illustrious career. Because *Pirates!* is plot-oriented, actions you take during a game have a profound effect on the status of your captain when he retires (you don't want to end up a beggar!). If you offend a town's governor, you won't be well received the next time you dock at an allied port. Impressing a governor, however, may win you the hand of his daughter in marriage and a wealth of inside information.

You'll spend most of your time sailing about the Caribbean and clashing with other ships. As with most other segments of the game, realism pervades your every decision in your voyages. You must be wary of raising your sails when you want your crew to fire on another vessel; they can't do both at once. At higher levels of difficulty your crew gives you little aid, and you must pay close attention to wind strength and direction to get you where you need to go. But watch out—if you don't keep your crew happy (read: rich and well fed), they'll desert.



Through a series of artful fencing combinations, you can reduce your opponent's morale from "Wild!" to "Shaken" and finally to "Panic."

When your crew boards an enemy ship you must duel with its captain. Sword fights are often frustrating in *Pirates!* for the same reason that the game is challenging: realism. Rather than stab at your opponent in arcade fashion, you must put together intelligent combinations of moves in order to defeat him.

The game isn't played only by sea—you'll go ashore to trade with town merchants, sign up men in taverns, and attack towns. You can improve your rank by fulfilling missions assigned you by governors you visit while in port.

Pirates!'s EGA graphics are boring during land and sea battles but they sport beautiful illustrations during other segments of the game. The program also plays music and sound effects that range from the sublime to the annoying; toggle them off if you wish. The documentation is outstanding—you're given all the historical background you could ever want, along with a map of the Caribbean during the game's time period.

Many of my criticisms of the program have to do with MicroProse's extreme copy-protection scheme. The program can't be loaded onto your hard disk because it doesn't run under DOS; in fact, DOS doesn't even recognize the disks. Each time you boot up with the game you must answer two ever-changing questions, the correct answers for which appear throughout the manual. You must swap disks constantly if you have only one floppy drive, and the Save Game procedure is awkward.

With either keyboard or joystick, scrolling through options is difficult. Very often I'd scroll down to an option and press Return, only to find that the cursor didn't respond to the keyboard. If you make such a mistake, you have to start from scratch because the program has no Escape key. The 5 key's use as an alternate Enter key also causes headaches.

From time to time the keyboard and screen freeze, leaving you with no option but to turn off the computer. While it doesn't happen often, you can lose some progress if you didn't save the game recently.

For all its frustrations, *Pirates!* is an ambitious game that has a lot to offer in the way of entertainment. And you might even get a history lesson along the way.

List Price: *Pirates!*, $39.95.
Requires: 256K RAM, CGA or EGA, one floppy disk drive, DOS 2.1 or later. Copy protected.
MicroProse Software Inc., 180 Lakefront Dr., Hunt Valley, MD 21030; (301) 771-1151, (800) 645-8632.

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A Treasure Trove of Seafaring Lore

If you always thought your history books were dry compared with the excitement of swashbuckler movies such as *Captain Blood*, you'll love the manual that accompanies MicroProse's *Pirates!* game. You'll not only learn a great deal about the pirates that roamed the high seas in the 16th and 17th centuries—you'll also get a painless (and entertaining) lesson in the history of the era.

While the fictional "Memoirs of Cap'n Sidney" gives you a glimpse into the colorful life of an English buccaneer, other sections of the manual impart information on subjects ranging from the Thirty Years' War to England's attempt to ruin free-trade Dutch merchants with their Navigation and Staple Acts. There's even some gossip thrown in. For instance, did you know that Sir Francis Drake was "a common seafarer from an undistinguished family"? Or that Spain's King Carlos II was "a deformed idiot (the unhappy product of excessive intermarriage by the Habsburgs)"?

The *Pirates!* manual is chock-full of interesting little tidbits like these, and it also provides information that could be helpful in increasing your score. So first read the manual, *then* play the game.—**Jennifer Zaino**

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PC MAGAZINE

AFTER HOURS

GAMES

Catch the Wave, Cop Some Rays, and Hang Ten with California Games

BY DONALD TRIVETTE

For those lazy, crazy nights of summer, Epyx Software gives us a refreshing treat. *California Games* is the gnarliest thing to happen to a computer since spreadsheets. Like, this is a collection of really rad action with six events in which you and the dudes on your beach can compete: skateboarding, tossing a flying disk, kicking a footbag, racing a BMX bike, skating the boardwalk, and, of course, the most totally tubular of all beach events, surfing.

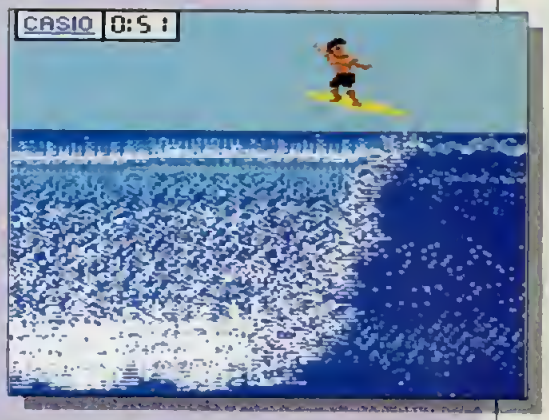
The skateboard contest is held in a half-pipe—a large U-shaped track—where your skill at hand plants, kick turns, and aerials determines your score. Staying on your board for the full 75 seconds is no mean "feet." Footbag is a laid-back kind of event—all you gotta do is keep the little bag in the air and slip in a few stunts like half-axels and dodas.

The flying disk, also known as Frisbee, is scored on accurate throwing and catching; and BMX and roller skating are obstacle-course events that require patience and skill.

BMX stands for Bicycle Motorcross, and the *California Games* version is almost as challenging as the real thing. You've got jumps, bumps, dips, and "Whoop-ti-dos" (rows of bumps) to throw you into a ditch and out of the race. Stunts score extra, from 100 points for an ordinary wheelie to 6,000 points for a perfect forward flip. You must complete the course in 2 minutes or less, and for every second under that you can rack up 60 additional points.

Roller skating is only slightly easier. The idea is to skate down the boardwalk without falling. You've got cracks in the concrete, grass, sand, and even stray shoes to avoid. There's no time limit; all you have to do is complete the course on your feet and show style.

Cal Games took more than 3 man-years of programming, and the effort is obvious, especially in the outstanding animation and realistic graphics in the surfing portion of the game. Perhaps this has something to do with the fact the program was written by a surfer/programmer. The wave is mathematically modeled on real-life wave dynamics and driven by a random-number generator that makes each wave slightly different. Your location on the wave and the angle of your board determine overall speed.



Kowabunga! A surfer in California Games catches air at the top of an awesome wave with 51 seconds left in his heat. Every wave is different.

You can "surf" with the keyboard or a joystick, and there's considerable controversy in my neighborhood over which is faster. The one criticism from experienced surfers is that *California Games* doesn't give you options about equipment or conditions. You can't, for example, select a long over a short board, or specify hurricane-size waves. The same criticism applies to the other events.

Just as in real competition, the surfing event is scored by a beach-bound panel of five judges who award points based on factors like time in the tube, catching air, and stylish maneuvers. The surfers at Epyx claim a high score of 9.8, but the best we've been able to do on the East Coast is 9.4. No one, say the programmers, knows if a perfect 10 is possible. We're trying, dude.

List Price: *California Games*, $39.95 **Requires:** 512K RAM; CGA, EGA, or VGA; joystick optional. Copy protected; hard-disk installable. Epyx Software, 600 Galveston Dr., Redwood City, CA 94063; (415) 366-0606.

CIRCLE **661** ON READER SERVICE CARD



Beach-blanket judges award a 9.2 out of a perfect 10 in the California Games *surfing contest. Pass the wine cooler and get out the volleyball*

AFTER HOURS INDEX

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Work like this doesn't just happen.

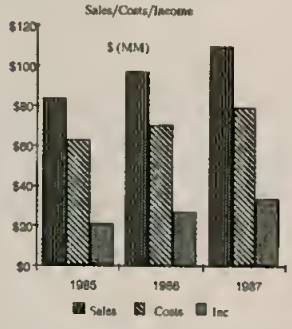
LKXS RADIOGRAPHY OPERATING GROUP

Review of Operations

During 1987, the LKXS radiography companies pressed forward vigorously with a series of product introductions and marketing programs designed to transform LKXS into a "new business" girded for continued growth in both the increasingly competitive U.S. biotechnology field and the emerging biotechnology market worldwide.

Profits Up in Growth Year

Throughout 1987, employees worked diligently to improve current product quality, control operating costs, and provide outstanding customer service. As a result, LKXS recorded its best profit year ever despite substantial expenditures to develop and introduce the Model NR^2.



To foster continued growth in overseas markets, we opened subsidiaries in Japan and Hong Kong.

These commitments have already paid off with international sales accounting for 7% of total revenues. Next year, we expect a strong showing as these subsidiaries continue to establish themselves.

1987 Revenues by Area

(Dollars in millions)

REGION	AMOUNT	PERCENT
Northwest	$ 3433	*35%*
Midwest	$ 2885	*29%*
New York	$ 1094	*11%*
New England	$ 1088	*11%*
Southwest	$ 713	*7%*
Int'l	$ 633	*7%*
TOTAL	$9846	100%

To make sure we stay closely in touch with our customers, in 1987 the LKXS companies expanded their customer service areas by 20%, spending $25 million to train their account management personnel.

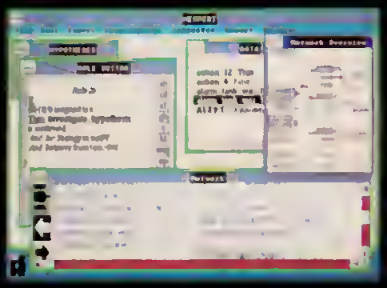
Model NR^2 is a Success

The introduction of the Model NR^2 is a good example of our success in pressing technology forward and communicating the benefits of this new technology to hospitals and research institutes around the world.

LKXS representatives introduced the Model NR^2 at major conferences in the field, both in the United States and overseas, to an

Applications keep pouring in for the Windows o

PC MAG
L I B R A R Y



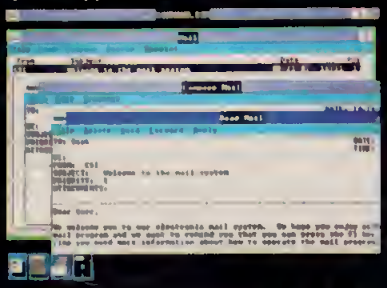
Nexpert Object, AI graphical expert system application, Nenron Data.



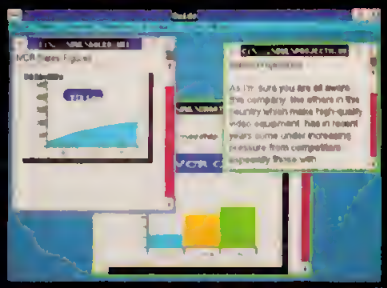
PageMaker, desktop pnblishing application, Aldns Corporation.



Omnis™ QUARTZ,™ mnlti-nser database application, Blyth Software, Inc.



The Network Courier, electronic mail application, Consumers Software, Inc.



Gnide, hypertext application, OWL International, Inc.



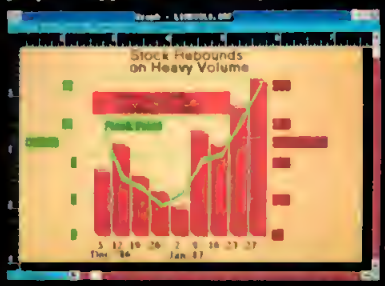
Windows DRAW,™ presentation graphics application, Micrografx, Inc.



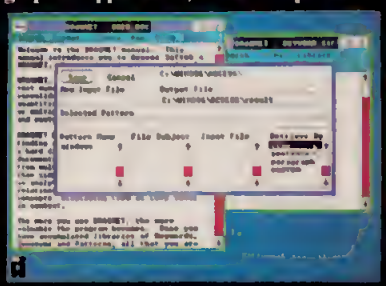
PC Paintbrush, color design and graphics application, ZSoft Corporation.



ClickStart!, applications organizer application, hDC Computer Corporation.



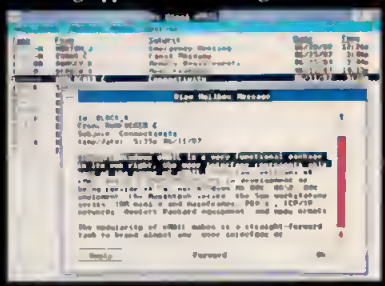
Windows GRAPH,™ business graphics/ charting application, Micrografx, Inc.



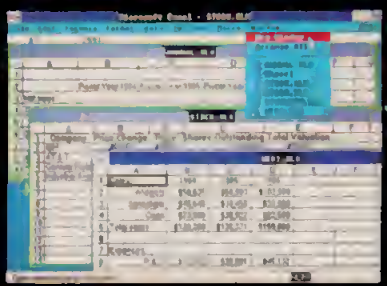
Dragnet, text retrieval application, Access Softek.



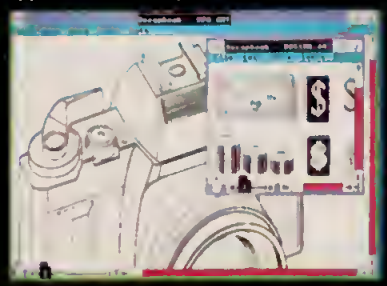
In*a*Vision,™ intermediate CAD application, Micrografx, Inc.



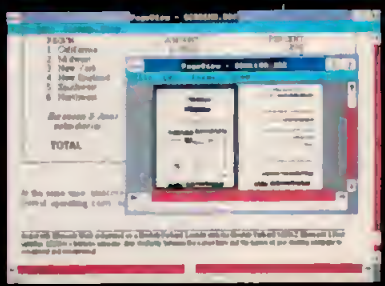
Windows Mail, electronic mail application, DaVinci Systems.



Microsoft Excel, spreadsheet application, Microsoft Corporation.



Scrapbook, art images application, T/Maker Company.



Microsoft Pageview, page preview/ graphics integration for Microsoft Word.

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